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A DETAILED NUMERICAL EVALUATION OF SHROUD PERFORMANCE FOR FINITE-BLADED DUCTED PROPELLERS

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OF SHROUD PERFORMANCE
FOR FINITE-BLADED DUCTED PROPELLERS

by

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ABSTRACT

Based on the three-dimensional theory developed at Therm Advanced Research, a simple procedure for calculating the detailed aerodynamic loading on the shroud of a finite-bladed ducted propeller in forward flight is presented.

This procedure has been designed for the evaluation of the several thousand configurations exactly represented by the tabulated values of the pertinent parameters, or reasonably approximated by them. In addition, configurations whose parameters fall somewhat in between or outside these values can be evaluated by suitable interpolation or extrapolation. The data were selected through liaison with propeller and aircraft manufacturers to encompass the current state of the art for ducted propeller design.

As a result, it is possible to carry out a number of calculations by hand quite readily which could not be done heretofore, for example, the examination of the effect of the propeller advance ratio.

TABLE OF CONTENTS

NOMENCLATURE

a	parameter for NACA 6-digit mean line, x_a/c ; equivalent to $(a-\frac{1}{2})$ of Ref. 13
a_ν	coefficients of shroud source strength distribution normalized for $t_m/c = 1$
c	shroud chord, see WORKSHEET I
$c_f^{2D}(x/c)$	linearized two-dimensional contribution of shroud thickness to shroud surface pressure coefficient
c_{ℓ_i}	two-dimensional design lift coefficient of NACA 6-digit mean line; equivalent to c_{ℓ_i} of Ref. 13
c_m	shroud sectional pitching moment coefficient about one-quarter chord, $m/\frac{1}{2}\rho U^2 c^2$
$c_p(x/c)$	shroud surface pressure coefficient, $(p-p_\infty)/\frac{1}{2}\rho U^2$
c_r	shroud sectional radial force coefficient, $r/\frac{1}{2}\rho U^2 c$
C_t	shroud thrust coefficient, $t/\frac{1}{2}\rho U^2 \pi R_p^2$
$c_{\Gamma'}(x/c)$	direct propeller contribution to shroud surface pressure coefficient
$C_{\Gamma' t}$	propeller-shroud thickness contribution to shroud thrust coefficient
$C_{\Gamma' t_\nu}$	ν^{th} term of $C_{\Gamma' t}$

c_{ν}^{3D}	three-dimensional Glauert coefficients of effective shroud camber
C_T	propeller thrust coefficient, $T/\frac{1}{2}\rho U^2 \pi R_p^2$
e	ratio of propeller radius to inner shroud surface radius at propeller plane, R_p/R_i
$F(\varphi, k)$	incomplete elliptic integral of the first kind with argument φ and modulus k
i	angle of incidence of shroud chord line relative to shroud axis, positive leading edge inward, see WORKSHEET I
J	propeller advance ratio, $U/\Omega R_p$
k, ℓ	dummy element indices, k designating row and ℓ designating column
m	parameter for NACA 4-digit mean line, y_m/c ; equivalent to m of Ref. 13
$\mathcal{m}$	shroud sectional pitching moment about quarter chord point or pitching moment per unit circumferential length, positive leading edge inward
N	number of propeller blades
$O_{k,\ell}$	elements for curvature correction of two-dimensional Glauert coefficients of effective shroud camber
p	parameter for NACA 4-digit mean line, x_m/c ; equivalent to $(p-\frac{1}{2})$ of Ref. 13

$p(x/c)$	static pressure on shroud surface
p_∞	free-stream static pressure
$Q_{k,\ell}$	elements for evaluation of camber induced by shroud thickness
$Q_{n-\frac{1}{2}}(\omega)$	Legendre function of the second kind and half integer order with argument ω, see Ref. 14
$\mathcal{r}$	shroud sectional radial force or radial force per unit circumferential length, positive outward
R	shroud reference radius, taken as radius of camber line at propeller plane, see WORKSHEET I
R_i	radius of shroud inner surface at propeller plane, see WORKSHEET I
R_p	propeller radius, see WORKSHEET I
$S_{k,\ell}$	elements for shroud curvature contribution to shroud surface pressure arising from effective shroud camber
$\mathcal{t}$	total axial force on shroud, positive upstream
t_m	maximum shroud thickness, see WORKSHEET I
t_p	shroud thickness at propeller plane, see WORKSHEET I
T	propeller thrust

$T_{k,\ell}$	elements for shroud curvature contribution to shroud surface pressure arising from shroud thickness
U	free stream velocity
$\frac{v(x/c)}{V}$	ratio of total local velocity on shroud induced by the two-dimensional thickness distribution to the free stream velocity, see Ref. 13
x, r	cylindrical coordinates with origin at center of shroud, see WORKSHEET I
x_a	axial position of aft end of constant portion of two-dimensional loading obtained from NACA 6-digit mean lines; measured relative to midchord, see WORKSHEET I
x_{cp}	axial position of shroud sectional center of pressure; measured relative to midchord, see WORKSHEET I
x_m	axial position of maximum ordinate of NACA 4-digit mean lines measured along shroud chord line; here taken relative to midchord in linearized sense, see WORKSHEET I
x_p	axial position of propeller plane; measured relative to midchord, see WORKSHEET I
y_m	maximum ordinate of NACA 4-digit mean line measured from shroud chord line; here taken in linearized sense as radial deviation, see WORKSHEET I
β	Glauert type variable for propeller circulation, $\cos^{-1}(r/R_p)$

$\Gamma(r/R_p)$, $\Gamma(\beta)$	propeller circulation distribution
$\Delta c_p^{2D}(x/c)$	two-dimensional net pressure coefficient for NACA 6-digit mean lines; equivalent to P_R of Ref. 13
$\epsilon(x/c)$	two-dimensional geometric camber
$\epsilon_{\Gamma'}(x/c)$	two-dimensional propeller induced camber
$\epsilon_{\Gamma',\nu}$	two-dimensional Glauert coefficients of propeller induced camber
ϵ_ν	two-dimensional Glauert coefficients of geometric camber
λ	ratio of shroud chord to shroud reference diameter, $c/2R$
μ	ratio of propeller radius to shroud reference radius, R_p/R
ν	dummy index
ρ	fluid density
χ	ratio of propeller plane position to shroud chord, x_p/c
Ω	angular velocity of propeller

A DETAILED NUMERICAL EVALUATION
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Introduction

Under the sponsorship of the Office of Naval Research, personnel of Therm Advanced Research have been engaged for the past four and one-half years in the general study of ducted propellers with finite blade number. As part of a long range ONR V/STOL program, the basic objective has been to provide a definitive analysis for different flight regimes.

A theory of the forward flight regime for zero angle of attack has been completed[1-6], including the effects of shroud camber, thickness and chord to diameter ratio, as well as the propeller loading, blade number, advance ratio, tip clearance and axial position. These results furnish not only general formulas for both the steady and harmonic shroud loads but also considerable physical insight into the overall problem. However, the analytic solution is not amenable to detailed aerodynamic evaluation because it requires the use of electronic computers to perform certain numerical calculations. Since the engineering value of any such solution is measured by the ease with which data can be extracted, these machine calculations were carried out at TAR for representative ducted propeller configurations. This report is the result: namely, the development of a simple procedure whereby the steady shroud net loading, surface pressures, thrust, sectional radial force, sectional pitching moment and sectional center of pressure can be calculated by hand.

To review briefly, the theory was derived as follows. The fluid is taken as inviscid and incompressible. Viewed in propeller-fixed coordinates, the duct is replaced by suitable distributions of sources and vortices on a cylindrical reference surface whose axis is coincident with the duct axis. The propeller blades are represented by individual radial vortex lines of varying circulation and accompanying trailing helical vortex sheets. If the form of the propeller circulation is assumed, the formulation of the governing equations then follows the procedure of thin lifting-surface theory. Within the limitations of this theory, we find that the problem for the steady load is equivalent to an axisymmetric ring wing[7] with the same thickness distribution as the given duct but an "effective" camber composed of the original geometric camber plus the radial wash of the shroud sources and propeller trailing vortices.

The source strength is simply proportional to the rate of change of airfoil thickness and its effects are quite readily adaptable to a hand calculation procedure[5, 6]. To determine the strength of the shroud vortices on the other hand, it is necessary to calculate the two-dimensional Glauert coefficients of the effective camber and correct them in turn for shroud curvature. The curvature correction is no difficulty but the calculation of the Glauert coefficients is, i.e., a technique for numerical Fourier analysis is required. Unfortunately the nature of the propeller contribution to the effective camber in particular is such that the available hand methods, e.g., Ref. 8, are inadequate. As a result, the Fourier analysis had to be carried out by machine and this, together with the propeller camber itself, constituted the major computational effort.

With regard to the propeller circulation, distributions for a so-called optimum without a hub are used. NACA thickness and camber distributions have been chosen for the shroud airfoil section. Data are tabulated for several values of the pertinent parameters which encompass the current state of the art for ducted propeller design. Utilizing all possible combinations of these tables enables the exact evaluation of several thousand ducted propeller configurations. Reasonable "non-exact" cases can be evaluated by proper interpolation or extrapolation.

Chapter One elaborates on the choice and other details of the propeller circulation, the shroud airfoil sections, and the range of the gross parameters of geometry and flight condition. The method of computation and related information for the tables, the format of the evaluation and a suggested interpolation or extrapolation technique are also presented. Chapter Two contains illustrative numerical examples giving all the work as it should appear on the worksheets. The report concludes with the actual evaluation procedure and the tabulated data.

It is hoped that this design procedure will pave the way for detailed evaluation and parametric study of ducted propeller configurations which were impracticable previously. It is also hoped that this report will be recognized as a source of information of a more universal nature, e.g., the Glauert coefficients for the NACA 4-, 5- and 6-digit mean lines.

CHAPTER ONE

GENERAL DISCUSSION

1.1 Propeller Circulation Distributions

The form of the distribution of the propeller circulation Γ determines the propeller induced camber ϵ_Γ, and the direct contribution of the propeller c_Γ, to the shroud surface pressure coefficient c_p. There are several choices. As opposed to our original thought[1], we have picked the classical Betz optimum[9] with a tip correction derived by T. Goodman[10] to account for the proximity of the duct. Since certain three-dimensional effects of both the propeller and shroud are omitted, such an optimum will not be a true one. Further difficulties may arise from viscous effects if the tip lies within the shroud boundary layer. Despite these complications, however, it should yield fairly accurate results for the propeller-shroud interaction phenomena and moreover, it is relatively easy to compute, cf. Ref. 11.

The specific circulation distributions used in the evaluation procedure are given in TABLES 1.1 - 1.3, each normalized so as to produce a unit propeller thrust coefficient $C_T = 1$ neglecting inflow. The other parametric inputs consist of the number of blades N, the ratio of the propeller radius to the radius of the inner shroud surface $e \equiv R_p/R_i$, and the propeller advance ratio or ratio of the forward speed to the tip speed $J \equiv U/\Omega R_p$. Because of the square-root behavior of these distributions at the tip, a Glauert-type angular variable β was introduced to insure sufficient accuracy. Though increments of only 5° are shown, increments down to 0.125° were computed in some cases. The corresponding radial stations r/R_p are given for convenience.

These circulation distributions are not used directly in the procedure but are presented for general information and completeness. For example, if evaluation for a different bladewise thrust gradient

$$\frac{dC_T/N}{dr/R_p} = \frac{2}{\pi J} \frac{\Gamma(r/R_p)}{R_p U} \frac{r}{R_p} \tag{1}$$

is desired, it can be approximated by superposition though this capability has not been incorporated explicitly in the procedure.

When a hub is present, the shape of the distribution is altered such that it cannot be fitted by the given distributions. However, these changes are relatively small and essentially confined to a region near the hub[12]. To simulate a hub in a crude fashion, configurations have been run in which the tabulated circulation distributions have been simply truncated at the hub. The results indicate that hubs with diameters up to about 25% of the propeller diameter have a negligible effect on the shroud performance and that the performance can be evaluated using the given circulation distributions. The direct effect of the radial velocity induced by the hub depends upon the shape and extent of the hub and can be estimated from slender body theory.

The results for the case of a uniform circulation have been compared with the tabulated distributions. Since they are independent of e and for a fixed value of C_T, also N and J, the number of calculations are greatly reduced but some discrepancies are introduced. In general, the two-dimensional Glauert coefficients of the propeller induced camber $\epsilon_{\Gamma',\nu}$ fall within the tabulated values for a given set of overall geometric parameters to be described later. The discrepancy in the values averages about 5%. For extremum values of J, though, the discrepancy can be as large as 20%. The same magnitude of discrepancy is also introduced in the direct propeller contribution to the shroud surface pressure coefficient $c_{\Gamma'}$, and the propeller-shroud thickness contribution to the shroud thrust coefficient $C_{\Gamma',t}$.

1.2 Shroud Thickness and Camber Distributions

In the evaluation procedure typical shroud thickness and camber distributions are represented by the NACA 4-, 5- and 6-digit series of airfoil sections and mean lines. These distributions have been selected because they are well known and data for them is readily available[13]. Other shapes may be obtained by superposition. Data is also included for the idealized case of zero thickness.

The scaling rules appropriate to each NACA airfoil and mean line have been incorporated in the design procedure. However, for 6-digit airfoil sections which can be scaled only within a given family and for 5-digit mean lines which can not be scaled, the evaluation procedure contains only data for those distributions which are listed in the TABLE OF PARAMETERS.

In general, standard NACA symbols are preserved, but those parameters which depend upon chordwise position are referred to the midchord of the shroud instead of the leading edge in order to be consistent with the coordinate system we have adopted, see WORKSHEET I. The 4- and 5-digit airfoil sections are characterized by the ratio of the maximum thickness to the chord t_m/c. The 6-digit airfoil sections are characterized by their family, i.e., the first two digits of the NACA designation; within a given family, the airfoil is characterized by the ratio t_m/c. The 4-digit mean lines are characterized by the ratio of the maximum mean line ordinate to the chord $m \equiv y_m/c$ and the ratio of the axial position of this ordinate to the chord $p \equiv x_m/c$. The 5-digit mean line is characterized by its NACA designation. The 6-digit mean line is characterized by the ratio of the axial position of the aft end of the constant portion of the two-dimensional loading to the chord $a \equiv x_a/c$ and the two-dimensional design lift coefficient c_{ℓ_i}.

1.3 Gross Geometry and Flight Parameters

As we have seen, the basic component parameters for the propeller circulation are C_T , N , e and J ; for the shroud thickness distribution, t_m/c or the NACA family designation; and for the shroud geometric camber distribution, m and p , or the NACA designation, or a and c_{ℓ_i} . In addition, there are three other parameters for the ducted propeller as a whole: the relative location of the propeller plane with respect to the midchord $\chi \equiv x_p/c$, the shroud chord to diameter ratio $\lambda \equiv c/2R$, where R is the reference radius of the shroud camber line at the propeller plane, and the ratio of the propeller radius to the reference radius $\mu \equiv R_p/R$. The thickness distribution parameter t_m/c is not an independent parameter of the problem. Once the values of λ , e , and μ are specified, the value of t_m/c for a given NACA airfoil section is uniquely determined. In order to eliminate the possibility of using the incorrect value of t_m/c , the evaluation procedure contains a method whereby the proper value is always computed.

The range of the parameters chosen is shown in the TABLE OF PARAMETERS. Certain of the parameters take on only specific values while others are arbitrary. Data has been generated and is presented for all possible combinations of the indicated values. In view of the large number of parameters, considerable selectivity had to be exercised. To make the values chosen as representative of ducted propeller practice as possible, two things were done. First we made an extensive compilation of the parameters for all the known configurations which have been tested and on this basis made our preliminary choices. This was followed up by discussion and contact with various propeller and aircraft manufacturers. Their thoughts then, together with consideration of what was a reasonable computational effort, guided us to the final values adopted.

1.4 Computation of Tables

Most of the tables were generated specifically for the present report. No derivations are given but the equations used are shown on the cover sheet which precedes each set. If necessary, these equations may be obtained from the cited references generally in the exact form as shown. In the cases where the form is different, an obvious change in variable and/or integration by parts is required. The rest of the tables were taken from previous reports and are simply reproduced.

Also included on the coversheet is the accuracy of the numbers and any pertinent information regarding the use of the tables. For example, on the cover sheet for TABLES 6.1 - 6.18, there are instructions for the use of the tables when $x = 0.25$. These instructions utilize certain symmetries in order to economize on the number of tables which have to be presented. It is thus important that the coversheets be read carefully before using the tables.

All new machine computations were carried out on the IBM 7090 or CDC 1604. The incomplete elliptic integral of the first kind $F(\varphi, k)$ was computed by a modified SHARE program and the Legendre function of the second kind and half integer order $Q_{n-\frac{1}{2}}(\omega)$ by our own program[14]. A Generalized Simpson's Rule was written for all integrals. In this program the interval of integration is successively halved until three consecutive answers are obtained which agree to within the prescribed accuracy.

We have checked and proofed the tables thoroughly. All equations have been double-checked for analytical correctness by rederivation, as well as all computer programs by both spot and sample hand calculations using numerical procedures different from the machine. Proof-reading has been done three times to insure that all data was transcribed accurately from the machine printout.

1.5 Format of Evaluation Procedure

The evaluation procedure consists of six (6) sub-procedures and two worksheets on which all calculations are done directly. The sub-procedures are:

1. DETERMINATION OF PARAMETERS
2. COMPUTATION OF THREE-DIMENSIONAL GLAUERT COEFFICIENTS OF EFFECTIVE CAMBER

3. COMPUTATION OF SHROUD SECTIONAL RADIAL FORCE AND MOMENT COEFFICIENTS AND CENTER OF PRESSURE

4. COMPUTATION OF SHROUD THRUST COEFFICIENT

5. COMPUTATION OF NET SHROUD PRESSURE COEFFICIENTS

6. COMPUTATION OF OUTER AND INNER SHROUD SURFACE PRESSURE COEFFICIENTS

Two sample prints of each worksheet accompany the report for trial calculations. Like the tables, the previous references should be consulted for the basic background on the manipulations involved.

The order in which the computations are done is essentially arbitrary, except for SUB-PROCEDURES 1 and 2. These must always be done first and in sequential order regardless of what other results are required. Once SUB-PROCEDURE 1 is completed, any of the remaining may be done by non-engineering personnel.

The sub-procedural instructions indicate what tables should be taken and where to write them on the worksheets. The worksheets are made up of an appropriate layout of the ducted propeller geometry and numbered columns. The worksheets, themselves, also contain a set of instructions which indicate the mathematical operations to be performed after completion of the respective sub-procedural steps. These instructions are written primarily in equation form using the column headings as the terms of the equations. The indicated operations are to be performed on each element in the column. The resulting directions of action of all forces and moments are shown pictorially.

1.6 Interpolation/Extrapolation

The evaluation procedure has been designed for the evaluation of the configurations exactly represented by the particular values chosen for the parameters or reasonably approximated by these values. Nevertheless, "non-exact" cases, i.e., configurations whose parameters fall somewhat in between or outside those tabulated, can be evaluated by suitable interpolation or extrapolation.

Experience has shown us that the best way is first to evaluate several "exact" configurations using values of the tabulated parameters which bound or adjoin those for the "non-exact" case and, then, to interpolate or extrapolate in the final results. The actual value of the arbitrary parameters are used in the evaluations with the exception of t_m/c. The value of t_m/c used must be consistent with the values of λ, e and μ as explained previously on p. 9. Although this technique requires the evaluation of several configurations, it has one great advantage. Namely, all other "non-exact" cases anywhere in the same region of interpolation or extrapolation are readily found.

Direct interpolation or extrapolation of the tabulated data before evaluation will also work, provided only one of the actual parameters does not correspond to the tabulated parameters. If more than one parameter is different, then one or more multiple interpolations or extrapolations are generally required. This becomes not only very complicated and time consuming, but results in the loss of accuracy through both computational and arithmetical errors.

CHAPTER TWO

ILLUSTRATIVE EXAMPLES

2.1 Background

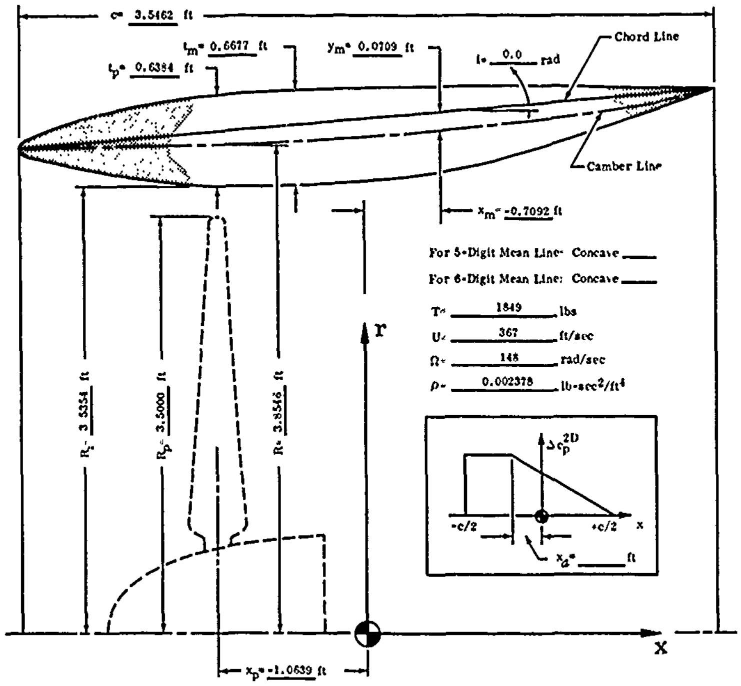
Three typical examples are presented to illustrate some of the ways in which the evaluation procedure can be applied, the numerical operations involved in each sub-procedure and the use of the tables. For each example a set of completed worksheets are given showing the proper number of decimal places consistent with the accuracy of the tables. We have kept three places for the most part. Where readily practicable, though, we have retained four places to minimize the accumulation of round-off errors.

2.2 Example for "Reasonably Approximate" Configurations

The first example is the complete evaluation of a configuration which is reasonably approximated by the tabulated data. The completed worksheets are reproduced in Figs. 1 and 2 and can be worked out straightforwardly by following the sub-procedures. The dimensions given correspond, of course, to the actual configuration, but the dimensions for the "reasonably approximate" configuration are found by modifications consistent with the chosen tabulated parameters. For the same propeller radius, the dimensions of this configuration are

$R_p = 3.5000$ ft , $c = 3.8889$ ft , $R_i = 3.5354$ ft ,

SUB-PROCEDURE 1
DETERMINATION OF PARAMETERS



GROSS GEOMETRIC AND FLIGHT PARAMETERS

PARAMETER	ACTUAL	EVALUATED
$C_T = T/\frac{1}{2}\rho U^2 \pi R_p^2$	0 300	0.300
N	3	3
$\epsilon = R_p/R_i$	0.990	0.990
$\chi = x_p/c$	-0.30	-0.25
$\mu = R_p/R$	0.908	0.900
$\lambda = c/2R$	0.46	0.50
$J = U/\Omega R_p$	0.71	0.75

THICKNESS PARAMETERS

PARAMETER	ACTUAL	EVALUATED
NACA AIRFOIL SECTION	4-DIGIT	4-DIGIT
t_m/c	0 1853	0.1836

GEOMETRIC CAMBER PARAMETERS

PARAMETER	ACTUAL	EVALUATED
NACA MEAN LINE	4-DIGIT	4-DIGIT
$p = x_m/c$	-0.200	-0.200
$m = y_m/c$	0.020	0.020
$a = x_a/c$	X	X
c_{l_i}	X	X
21	0.0	0.0

COMPUTATION OF THR

① 4 = 2 + 3
5 = 1 × 4

ν	1	2	3	4	5
0	1.4845	0.1836	1	0.1836	0.2
1	-3.1513			↓	-0.
2	-1.5480				-0.2
3	2.4390				0.4
4	-4.0600				-0.7
5	0				0
6	0				0

6	7	8	9	10	11	12	13	14
0.7698	0.2726	0.3854	-0 5786	0	-0.2842	0.0320	0.4478	0
-0.2197	↓	0	↓	0.0551	↓	0	↓	0.0082
0.0252		0.0557		0		-0.0026		0
-0.0052		0		-0.0109		0		-0.0004
0.0025		0.0052		0		0.0025		0
-0.0013		0		-0.0015		0		-0.0006
0.0007		0.0015		0		0.0005		0

④ 29 = 27 × 28
33 = 31 × 32
36 = 29 + 30
37 = 33 × 35
38 = 34 × 35
39 = 36 + 37 + 38

ν	27	28	29	30	31	32	33	34
0	0.982	0.020	0.020	0.0	-0.196	0.300	-0.059	0.0
1	-8.659	↓	-0.173	0	0.103	↓	0.032	-0.0
2	-2.964		-0.059	↓	-0.045		-0.014	-0.
3	-1.185		-0.024		-0.052		-0.016	0.0
4	0.024		0.000		-0.014		-0.004	-0.0
5	0.408		0.003		0.011		0.003	0.0
6	0.223		0.004		0.012		0.004	-0.0
7	-0.070		-0.001		0.003		0.001	0
8	-0.167		-0.003		-0.004		-0.001	↓
9	-0.065		-0.001		-0.004		-0.001	
10	0.064		0.001		-0.001		0.000	
11	0.086		0.002		0.001		0.000	
12	0 014		0 000		0 001		0 000	

40	41	42	43	44	45	46	47	48
1.0796	0.078	0	-0.123	0.0400	-0.018	0	-0.010	-0.0002
0.1719	↓	1.0933	↓	0.0064	↓	-0.0139	↓	0.0000
0.0274		0		1.0179		0		-0.0042
-0 0003		-0 0046		0 0000		1 0062		0.0000
-0.0002		0		-0.0021		0		1.0032
0 0000		0 0000		0 0000		-0 0012		0.0000
0.0000		0		0.0000		0		-0.0008

SUB-PROCEDURE 3
COMPUTATION OF SHROUD SECTIONAL RADIAL FORCE AND MOMENT COEFFICIENTS AND CENTER OF PRESSURE

① Write the first three elements of COLUMN 61 as the element of COLUMNS 62, 63 and 64 respectively.

62	63	64
0.084	-0.121	-0.016

	65	66
$-\pi$	-3.1416	-0.264

② 66 = 62 × 65
68 = 63 × 67

c_ℓ = 69 = 66 + 68

	67	68	69
$-\pi/2$	-1.5708	0.190	-0.074

③ 71 = 63 × 70
73 = 64 × 72

c_m = 74 = 71 + 73

	70	71
$-\pi/8$	-0.3927	0.049

	72	73	74
$\pi/8$	0.3927	-0.006	0.012

④ 75 = 74 + 69

x_{cp}/c = 77 = 75 + 76

75	76	77
-0.568	-0.250	-0.818

COM

① Write the elements of COLUMN 5 as the elements of COLUMN 79.

② Write the elements of COLUMN 33, corresponding to ν=1,2,3 ... 11, as the corresponding elements of COLUMN 87

③ Write the elements of COLUMN 33, corresponding to ν=2,3,4 ... 12, as the corresponding elements of COLUMN 86.

④ Write the first element of COLUMN 33, corresponding to ν=0, as the element of COLUMN 89.

⑤ Write the second element of COLUMN 33, corresponding to ν=1, as the element of COLUMN 90.

⑥ Write the elements of COLUMN 61, corresponding to ν=2,3,4 .. 12, as the corresponding elements of COLUMN 91

⑦ Write the elements of COLUMN 61, corresponding to ν=1,2,3 ... 11, as the corresponding elements of COLUMN 87.

⑧ Write the first element of COLUMN 61, corresponding to ν=0, as the element of COLUMN 91.

⑨ Write the second element of COLUMN 61, corresponding to ν=1, as the element of COLUMN 92.

⑩ 80 = 78 × 79
82 = 80 × 81
85 = 83 × 84
88 = 86 × 87

⑪ 94 = 89 × 91
96 = 89 × 92
98 = 90 × 92
100 = Algebraic sum of 85

ν	78
0	-0.004
1	0.056
2	0.020
3	0.000
4	0.003
5	0.000
6	0.000

89	90	91
-0.059	0.032	0.084

93	94	95
4.000	-0.005	2.000

	101	102	103
$\pi/8$	0.3927	0 002	-0.020

110	111	112
-4.000	0.900	0.500

FIGURE 1

COMPLETED WORKSHEET I FOR "REASONABLY APPROXI

I

SUB-PROCEDURE 2

COMPUTATION OF THREE-DIMENSIONAL GLAUERT COEFFICIENTS OF EFFECTIVE CAMBER

ν	1	2	3	4	5
0	1.4845	0.1836	1	0.1836	0.2726
1	-3.1513				-0.5786
2	-1.5480				-0.2842
3	2.4390				0.4478
4	-4.0600				-0.7454
5	0				0
6	0				0

② Write the elements of column 5 as the first element of columns 7, 9, 11, 13, 15, 17 and 19 respectively.

③ 20 = 6 × 7
21 = 8 × 9
22 = 10 × 11
23 = 12 × 13
24 = 14 × 15
25 = 16 × 17
26 = 18 × 19
34 = 20 + 21 + 22 + 23 + 24 + 25 + 26

10	11
[illegible]	-0.2842
·61	
[illegible]	
·100.	
[illegible]	
·15	
[illegible]	

12	13
0.0320	0.4478
0	
-0.0026	
0	
0.0025	
0	
0.0005	

14	15
0	-0.7454
0.6082	
0	
-0.0004	
0	
-0.0006	
0	

16	17
0.0048	0
0	
-0.0009	
0	
0.0003	
0	
0.0002	

18	19
0	0
0.0015	
0	
0.0001	
0	
-0.0001	
0	

20	21	22	23	24	25	26
0.209·	-0.2530	0	0.0143	0	0	0
-0.0599	0	-0.0157	0	-0.0061	0	0
0.0069	-0.0322	0	-0.0012	0	0	0
-0.0014	0	0.0031	0	0.0003	0	0
0.0007	-0.0430	0	0.0011	0	0	0
-0.0004	0	0.0004	0	0.0004	0	0
0.0002	-0.0009	0	0.0002	0	0	0

29	30	31	32	33	34	35	36	37	38	39	ν
·080	0.0	-0.196	0.300	-0.059	0.001	-1	0.020	0.059	-0.001	0.078	0
·173	0	0.108		0.032	-0.032		-0.173	-0.032	0.032	-0.123	1
[illegible]		-0.045		-0.014	-0.027		-0.059	0.014	0.027	-0.018	2
·024		-0.052		-0.016	0.002		-0.024	0.016	-0.002	-0.010	3
·000		-0.014		-0.004	-0.001		0.000	0.004	0.001	0.005	4
·008		0.011		0.003	0.000		0.008	-0.003	0.000	0.005	5
·004		0.012		0.004	-0.001		0.004	-0.004	0.001	0.001	6
·001		0.003		0.001	0		-0.001	-0.001	0	-0.002	7
·003		-0.004		-0.001			-0.003	0.001	0	-0.002	8
·001		-0.004		-0.001			-0.001	0.001	0	0.000	9
·001		-0.001		0.000			0.001	0.000	0	0.001	10
·002		0.001		0.000			0.002	0.000	0	0.002	11
·000		0.001		0.000			0.000	0.000	0	0.000	12

⑤ Write the first seven elements of column 39 as the first element of columns 41, 43, 45, 47, 49, 51 and 53 respectively.

⑥ 54 = 40 × 41
55 = 42 × 43
56 = 44 × 45
57 = 46 × 47
58 = 48 × 49
59 = 50 × 51
60 = 52 × 53

44	45
·0400	-0.018
·064	
·179	
·000	
·0021	
·0000	
·0000	

46	47
0	-0.010
-0.0138	
0	
1.0062	
0	
-0.0012	
0	

48	49
-0.0002	0.005
0.0000	
-0.0042	
0.0060	
1.0032	
0.0000	
-0.0008	

50	51
0	0.005
0.0001	
0	
-0.0020	
0	
1.0020	
0	

52	53
0.0000	0.001
0.0000	
0.0000	
0.0000	
-0.0012	
0.0000	
1.0013	

54	55	56	57	58	59	60
0.0842	0	-0.0007	0	0 0000	0	0 0000
0.0134	-0 1345	-0.0001	0.0001	0.0000	0.0000	0.0000
0 0021	0	-0.0183	0	0.0000	0	0.0000
-0.0001	0.0406	0.0000	-0.0101	0 0000	0.0000	0 0000
0.0000	0	0.0000	0	0.0050	0	0 0000
0.0000	0.0400	0.0000	0 0000	0.0000	0.0050	0.0000
0.0000	0	0.0000	0	0 0000	0	0 0010

ν	61
0	0 084
1	-0.121
2	-0.016
3	-0 010
4	0.005
5	0.005
6	0.001
7	-0.002
8	-0.002
9	0.000
10	0.001
11	0.002
12	0.000

⑦ $c_\nu^{3D} = 61 = 54 + 55 + 56 + 57 + 58 + 59 + 60\ ,\ \nu = 0, 1, 2 \ldots 6$

$c_\nu^{3D} = 61 = 39\ ;\ \nu = 7, 8, 9 \ldots 12$

SUB-PROCEDURE 4

COMPUTATION OF SHROUD THRUST COEFFICIENT

·e elements of column 79.

Write the elements of column 61, corresponding to ν=1,2,3 .. 11, as the corresponding elements of column 87.

Write the first element of column 61, corresponding to ν=0, as the element of column 91.

Write the second element of column 61, corresponding to ν=1, as the element of column 92.

ν	78	79	80	81	82
0	-0.004	0.2726	-0.0011	0.300	0.000
1	0.056	-0 5756	-0.0324		-0.010
2	0.020	-0.2842	-0.0057		-0 002
3	0.000	0 4478	0 0000		0.000
4	0.003	-0.7454	-0.0022		-0.001
5	0.000	0	0		0
6	0.000	0	0		0

ν	83
1	0.032
2	-0.014
3	-0.016
4	-0 004
5	0.005
6	0.004
7	0.001
8	-0.001
9	-0.001
10	0.000
11	0.000

ν	84
2	-0.016
3	-0.010
4	0 005
5	0.005
6	0.001
7	-0 002
8	-0 002
9	0.000
10	0.001
11	0.002
12	0.000

85
-0.001
0 000
0 000
0 000
0.000
0.000
0 000
0.000
0.000
0.000
0.000

ν	86
2	-0 014
3	-0.016
4	-0.004
5	0 003
6	0 004
7	0 001
8	-0 001
9	-0.001
10	0.000
11	0.000
12	0.000

ν	87
1	-0 121
2	-0 016
3	0.010
4	0.005
5	0.005
6	0 001
7	-0 002
8	-0.002
9	0.000
10	0.001
11	0.002

88
0 002
0 000
0 000
0.000
0.000
0 000
0 000
0.000
0.000
0.000
0.000

89	90	91	92
-0.059	0.032	0.084	-0.121

93	94	95	96	97	98	99	100
4.000	-0.005	2.000	0. 07	-2.000	-0.004	-1	-0.001

π/8 —

101	102	103	104	105	106	107	108	109
0.3927	0.002	-0.020	0.014	0.004	0.001	0.005	0.002	-0.013

·sum of 85

110	111	112	113	114	115	116	117
-4.000	0.900	0.500	-4.4444	0.5556	-2.4693	-0.011	0.027

⑫ 102 = Algebraic sum of 88
103 = 93 × 94
104 = 95 × 96
105 = 97 × 98
106 = 99 × 100
107 = 102 + 103 + 104 + 105 + 106
108 = 101 × 107
109 = Algebraic sum of 82

⑬ 113 = 1 . . ÷ 111
114 = 112 + 111
115 = 113 × 114
116 = 108 + 109

c_t = 117 = 115 × 116

·URE 1

·ONABLY APPROXIMATE" CONFIGURATION

2

SUB-PROCEDURE 5

COMPUTATION OF NET SHROUD PRESSURE COEFFICIENTS

① Write the elements of COLUMN 61 on WORKSHEET I as the first element of COLUMNS 119, 121, 123, 125, 127, 129, 131, 133, 135, 137, 139, 141 and 143 respectively.

118	119	120	121	122	123	124	125	126	127	128	129	130	131	132
∞	0.084	0	-0.121	0	-0.016	0	-0.010	0	0.005	0	0.005	0	0.001	0
3.0000	↓	0.6000	↓	0.9600	↓	0.9360	↓	0.5376	↓	-0.0758	↓	-0.6589	↓	-0.9786
2.0000		0.8000		0.9600		0.3520		-0.5376		-0.9971		-0.6589		0.2064
1.5275		0.9165		0.7332		-0.3300		-0.9972		-0.4678		0.6229		0.9661
1.2248		0.9798		0.3919		-0.8230		-0.7211		0.5346		0.9350		-0.1606
1.0000		1.0000		0		-1.0000		0		1.0000		0		-1.0000
0.8165		0.9798		-0.3919		-0.8230		0.7211		0.5346		-0.9350		-0.1606
0.6547		0.9165		-0.7332		-0.3300		0.9972		-0.4678		-0.6229		0.9661
0.5000		0.8000		-0.9600		0.3520		0.5376		-0.9971		0.6589		0.2064
0.3333		0.6000		-0.9600		0.9360		-0.5376		-0.0758		0.6589		-0.9786
0		0		0		0		0		0		0		0

② 144 = 118 × 119
145 = 120 × 121
146 = 122 × 123
147 = 124 × 125
148 = 126 × 127
149 = 128 × 129
150 = 130 × 131

144	145	146	147	148	149	150	151	152	153	154	155	156	157	158	x/c	159
∞	0	0	0	0	0	0	0	0	0	0	0	0	∞	-2.000	-0.5	-∞
0.2520	-0.0726	-0.0154	-0.0094	0.0027	-0.0004	-0.0007	0.0020	-0.0018	0.0000	0.0002	0.0014	0.0000	0.162	↓	-0.4	-0.324
0.1680	-0.0968	-0.0154	-0.0035	-0.0027	-0.0050	-0.0007	-0.0004	-0.0018	0.0000	0.0002	-0.0014	0.0000	0.041		-0.3	-0.082
0.1283	-0.1109	-0.0117	0.0033	-0.0050	-0.0023	0.0006	-0.0019	-0.0003	0.0000	-0.0008	0.0004	0.0000	0.000		-0.2	0.000
0.1029	-0.1186	-0.0063	0.0082	-0.0036	0.0027	0.0009	0.0003	0.0020	0.0000	0.0009	0.0012	0.0000	-0.009		-0.1	0.018
0.0840	-0.1210	0	0.0100	0	0.0050	0	0.0020	0	0.0000	0	-0.0020	0	-0.022		0.0	0.044
0.0686	-0.1186	0.0063	0.0082	0.0036	0.0027	-0.0009	0.0003	-0.0020	0.0000	-0.0009	0.0012	0.0000	-0.032		0.1	0.064
0.0550	-0.1109	0.0117	0.0033	0.0050	-0.0023	-0.0006	-0.0019	0.0003	0.0000	0.0008	0.0004	0.0000	-0.039		0.2	0.078
0.0420	-0.0968	0.0154	-0.0035	0.0027	-0.0050	0.0007	-0.0004	0.0018	0.0000	-0.0002	-0.0014	0.0000	-0.045		0.3	0.090
0.0280	-0.0726	0.0154	-0.0094	-0.0027	-0.0004	0.0007	0.0020	-0.0018	0.0000	-0.0002	0.0014	0.0000	-0.040		0.4	0.050
0	0	0	0	0	0	0	0	0	0	0	0	0	0		0.5	0

SUB-PROCEDURE 6

COMPUTATION OF OUTER AND INNER SHROUD SURFACE PRESSURE COEFFICIE

① Write the first seven elements of COLUMN 61 on WORKSHEET I as the first element of COLUMNS 161, 163, 165, 167, 169, 171 and 173 respectively.

160	161	162	163	164	165	166	167	168	169	170	171	172	173	174	175	176	177	178
1.2088	0.084	0.6058	-0.121	0	-0.016	-0.0016	-0.010	0	0.005	0.0000	0.005	0	0.001	0.0224	0.2726	0	-0.5786	-0.0056
-0.5177	↓	0	↓	-0.2599	↓	0	↓	0.0011	↓	0	↓	0.0000	↓	0.0702	↓	0.0408	↓	0
0.0057		0.1300		0		-0.1274		0		0.0003		0		0.0140		0		-0.0036
0.0021		0		0.0549		0		-0.0840		0		0.0001		-0.0009		-0.0022		0
0.0000		-0.0003		0		0.0630		0		-0.0628		0		0.0000		0		0.0000
0.0000		0		-0.0001		0		0.0502		0		-0.0501		0.0000		-0.0001		0
0.0000		0.0000		0		-0.0001		0		0.0418		0		0.0000		0		0.0000

③ 188 = 160 × 161
189 = 162 × 163
190 = 164 × 165
191 = 166 × 167
192 = 168 × 169
193 = 170 × 171
194 = 172 × 173

188	189	190	191	192	193	194	195	196	197	198	199	200	201	202	203	204
0.1015	-0.0733	0	0.0000	0	0.0000	0	0.0061	0	0.0016	0	0.0006	0	0	0.037	-1	-0.037
-0.0435	0	0.0042	0	0.0000	0	0.0000	0.0191	-0.0236	0	0.0011	0	0	0	-0.043	↓	0.043
0.0005	-0.0157	0	0.0013	0	0.0001	0	0.0035	0	0.0010	0	0.0004	0	0	-0.009		0.009
0.0002	0	-0.0014	0	-0.0004	0	0.0000	-0.0002	0.0013	0	0.0001	0	0	0	0.000		0.000
0.0000	0.0000	0	-0.0006	0	-0.0003	0	0.0000	0	0.0000	0	0.0000	0	0	-0.001		0.001
0.0000	0	0.0000	0	0.0003	0	-0.0001	0.0000	0.0001	0	0.0000	0	0	0	0.000		0.000
0.0000	0.0000	0	0.0000	0	0.0002	0	0.0000	0	0.0000	0	0.0000	0	0	0.000		0.000

④

⑥ Write the elements of COLUMN 204 as the first element of COLUMNS 206, 208, 210, 212, 214, 216 and 218 respectively.

205	206	207	208	209	210	211	212	213	214	215	216	217
0.5000	-0.037	-0.5000	0.043	-0.5000	0.009	-0.5000	0.000	-0.5000	0.001	-0.5000	0.000	-0.5000
0.5000	↓	-0.4000	↓	-0.1400	↓	0.1760	↓	0.3816	↓	0.4986	↓	0.3781
0.5000		-0.3000		0.1400		0.4680		0.4216		0.0379		-0.3781
0.5000		-0.2000		0.3400		0.4720		0.0376		-0.4419		-0.3911
0.5000		-0.1000		0.4600		0.2840		-0.3464		-0.4226		0.1774
0.5000		0		0.5000		0		-0.5000		0		0.5000
0.5000		0.1000		0.4600		-0.2840		-0.3464		0.4226		0.1774
0.5000		0.2000		0.3400		-0.4720		0.0376		0.4419		-0.3911
0.5000		0.3000		0.1400		-0.4680		0.4216		-0.0379		-0.3781
0.5000		0.4000		-0.1400		-0.1760		0.3816		-0.4986		0.3781
0.5000		0.5000		-0.5000		0.5000		-0.5000		0.5000		-0.5000

⑧ 230 = 228 + 229

Write the element of COLUMN 230 as the second element of COLUMN 232

For NACA 4- or 5-digit airfoil sections, write the value 1.000 in the last element of COLUMN 232

OR

For NACA 6-digit airfoil sections, write the element of COLUMN 230 as the last element of COLUMN 232

233 = 231 × 232
235 = 233 + 234
236 = 233 × 235
241 = 236 + 234

226	227	228	229	230	231	232	233	234	235	236	237	238	239	240	241	242	x/c	243	244
-0.129	0.300	[illegible]	0.18	1.020	2.000	1.000	2.000	-4.000	-2.000	-4.000	-1	∞	-0.045	-0.033	1.000	-∞	-0.5	∞	-∞
-0.116	↓				-0.552	1.020	-0.563	↓	-4.563	2.559	↓	0.162	-0.037	-0.035	-0.642	-0.162	-0.4	-0.552	-0.876
-0.057					-0.550	↓	-0.561		-4.561	2.559		0.041	-0.036	-0.017	-0.640	-0.041	-0.3	-0.646	-0.728
0.057					-0.494		-0.504		-4.504	2.270		0.000	-0.024	0.017	-0.568	0.000	-0.2	-0.575	-0.578
0.116					-0.410		-0.418		-4.418	1.847		-0.009	-0.019	0.035	-0.462	0.009	-0.1	-0.455	-0.437
0.129					-0.309		-0.314		-4.314	1.355		-0.022	-0.015	0.039	-0.339	0.022	0.0	-0.337	-0.292
0.124					-0.232		-0.237		-4.237	1.004		-0.032	-0.014	0.038	-0.251	0.032	0.1	-0.255	-0.191
0.118					-0.149		-0.151		-4.151	0.627		-0.039	-0.007	0.035	-0.157	0.039	0.2	-0.168	-0.090
0.109					-0.050		-0.051		-4.051	0.207		-0.045	-0.004	0.033	-0.052	0.045	0.3	-0.068	0.022
0.100					0.063		0.069		-3.931	-0.271		-0.040	-0.002	0.030	0.068	0.040	0.4	0.056	0.136
0.091					2.000	1.000	2.000		-2.000	-4.000		0	-0.002	0.027	1.000	0	0.5	1.025	1.036

FIGURE 2

COMPLETED WORKSHEET II FOR "REASONABLY APPROXI

II

EDURE 5
D PRESSURE COEFFICIENTS

129
-0.005

130	131
0	0.001
-0.6589	
-0.6589	
0.6229	
0.9350	
0	
-0.9350	
-0.6229	
0.6589	
0.6589	
0	

132	133
0	-0.002
-0.9785	
0.2064	
0.9661	
-0.1606	
-1.0000	
-0.1606	
0.9661	
0.2064	
-0.9785	
0	

134	135
0	-0.002
-0.9066	
0.9066	
0.1500	
-0.9992	
0	
0.9992	
-0.1500	
-0.9066	
0.9066	
0	

136	137
0	0.000
-0.4721	
0.8816	
-0.8462	
-0.2391	
1.0000	
-0.2391	
-0.8462	
0.8816	
-0.4721	
0	

138	139
0	0.001
0.1513	
0.1513	
-0.8269	
0.8959	
0	
-0.8959	
0.8269	
-0.1513	
-0.1513	
0	

140	141
0	0.002
0.7141	
-0.7000	
0.1847	
0.6005	
-1.0000	
0.6005	
0.1847	
-0.7000	
0.7141	
0	

142	143
0	0.000
0.9913	
-0.9913	
0.9746	
-0.6646	
0	
0.6646	
-0.9746	
0.9913	
-0.9913	
0	

157	158
∞	-2.000
0.162	
0.041	
0.000	
-0.009	
-0.022	
-0.032	
-0.039	
-0.045	
-0.040	
0	

x/c	159
-0.5	-∞
-0.4	-0.324
-0.3	-0.082
-0.2	0.000
-0.1	0.018
0.0	0.044
0.1	0.064
0.2	0.078
0.3	0.090
0.4	0.080
0.5	0

+ −

(3) 151 = 132 × 133
152 = 134 × 135
153 = 136 × 137
154 = 138 × 139
155 = 140 × 141
156 = 142 × 143
157 = 144 + 145 + 146 + 147 + 148 + 149 + 150 + 151 + 152 + 153 + 154 + 155 + 156

Δc_p = 159 = 157 × 158

EDURE 6
UD SURFACE PRESSURE COEFFICIENTS

175
0.2726

176	177
0	-0.5786
0.0408	
0	
-0.0022	
0	
-0.0001	
0	

178	179
-0.0056	-0.2842
0	
-0.0036	
0	
0.0000	
0	
0.0000	

180	181
0	0.4478
0.0024	
0	
0.0002	
0	
-0.0001	
0	

182	183
-0.0008	-0.7454
0	
-0.0006	
0	
0.0000	
0	
0.0000	

184	185
0	[illegible]
0.0003	
0	
0.0000	
0	
0.0000	
0	

186	187
-0.0002	0
0	
-0.0001	
0	
0.0000	
0	
0.0000	

(2) Write the elements of COLUMN 5 on WORKSHEET I as the first element of COLUMNS 175, 177, 179, 181, 183, 185 and 187 respectively.

202	203	204
0.037	-1	-0.037
-0.043		0.043
-0.009		0.009
0.000		0.000
-0.001		0.001
0.000		0.000
0.000		0.000

(4) 195 = 174 × 175
196 = 176 × 177
197 = 178 × 179
198 = 180 × 181
199 = 182 × 183
200 = 184 × 185
201 = 186 × 187

(5) 202 = 188 + 189 + 190 + 191 + 192 + 193 + 194 + 195 + 196 + 197 + 198 + 199 + 200 + 201
204 = 202 × 203

214
0.001

215	216
-0.5000	0.000
0.4986	
0.0379	
-0.4419	
-0.4226	
0	
0.4226	
0.4419	
-0.0379	
-0.4986	
0.5000	

217	218
-0.5000	0.000
0.3761	
-0.3761	
-0.3911	
0.1774	
0.5000	
0.1774	
-0.3911	
-0.3761	
0.3761	
-0.5000	

219	220	221	222	223	224	225
-0.0185	-0.0215	-0.0045	0.0000	-0.0005	0.0000	0.0000
-0.0185	-0.0172	-0.0013	0.0000	0.0004	0.0000	0.0000
-0.0185	-0.0129	0.0013	0.0000	0.0004	0.0000	0.0000
-0.0185	-0.0086	0.0031	0.0000	0.0000	0.0000	0.0000
-0.0185	-0.0043	0.0041	0.0000	-0.0003	0.0000	0.0000
-0.0185	0	0.0045	0	-0.0005	0	0.0000
-0.0185	0.0043	0.0041	0.0000	-0.0003	0.0000	0.0000
-0.0185	0.0086	0.0031	0.0000	0.0000	0.0000	0.0000
-0.0185	0.0129	0.0013	0.0000	0.0004	0.0000	0.0000
-0.0185	0.0172	-0.0013	0.0000	0.0004	0.0000	0.0000
-0.0185	0.0215	-0.0045	0.0000	-0.0005	0.0000	0.0000

(7) 219 = 205 × 206
220 = 207 × 208
221 = 209 × 210
222 = 211 × 212
223 = 213 × 214
224 = 215 × 216
225 = 217 × 218

241	242
1.000	-∞
-0.642	-0.162
-0.640	-0.041
-0.568	0.000
-0.462	0.009
-0.339	0.022
-0.251	0.032
-0.157	0.033
-0.052	0.045
0.068	0.040
1.000	0

x/c	243	244
-0.5	∞	-∞
-0.4	-0.552	-0.876
-0.3	-0.646	-0.728
-0.2	-0.575	-0.575
-0.1	-0.455	-0.437
0.0	-0.337	-0.293
0.1	-0.255	-0.191
0.2	-0.165	[illegible]
0.3	-0.068	0.022
0.4	0.056	0.136
0.5	1.025	1.025

+ −

(9) Write the elements of COLUMN 157 as the corresponding elements of COLUMN 238

239 = 219 + 220 + 221 + 222 + 223 + 224 + 225
240 = 226 × 227
242 = 237 × 238

c_p (OUTER) = 243 = 238 + 239 + 240 + 241
c_p (INNER) = 244 = 239 + 240 + 241 + 242
QUADRATIC

c_p (OUTER) = 243 = 233 + 238 + 239 + 240
c_p (INNER) = 244 = 233 + 239 + 240 + 242
LINEAR

RE 2

NABLY APPROXIMATE'' CONFIGURATION

2

x_p = -0.9722 ft , and t_p = 0.7070 ft . The "new" value of t_p used in the calculations was 0.6614 ft ; see STEP 4 of SUB-PROCEDURE 1. It should also be noted that the value of Ω changes to 140 rad/sec. The respective configurations are drawn to scale in Fig. 3 and do not appear appreciably different.

An "exact" evaluation of the actual configuration has also been run by means of the general computer programs. The worksheets, completed as if tables were available for these values of the parameters, are shown in Figs. 4 and 5. For this case the tabulated data for $\Gamma(\beta)/R_pU$ was generated by using the equations given on the cover-sheet for TABLES 1.1 - 1.3 with $F(\varphi, k)/F(\pi/2, k)$ being obtained by four-point Lagrangian interpolation of data not published in this report but which is available in the general computer program. Similarly, the elements $O_{k,\ell}$ were obtained by three-point Lagrangian interpolation of data in Ref. 2, and the elements $Q_{k,\ell}$ and $T_{k,\ell}$ by three-point Lagrangian interpolation of the appropriate tables contained in this report. Within the range of the parameters N , e , J and λ , the interpolated results are as accurate as those which can be obtained by actual calculations using the equations on the appropriate cover-sheet.

The relative magnitudes of the shroud sectional force and moment coefficients and center of pressure, the shroud thrust coefficient and

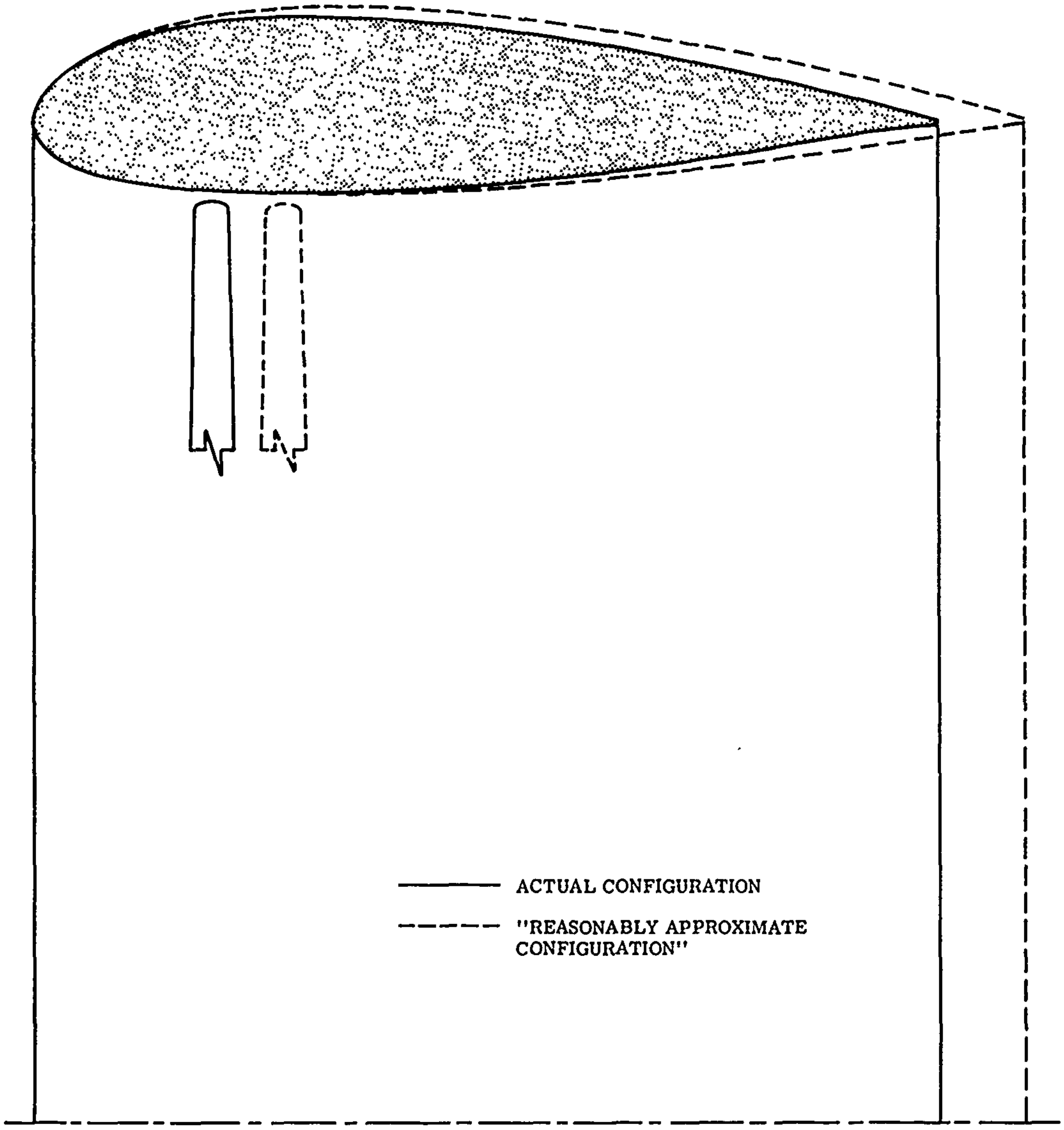
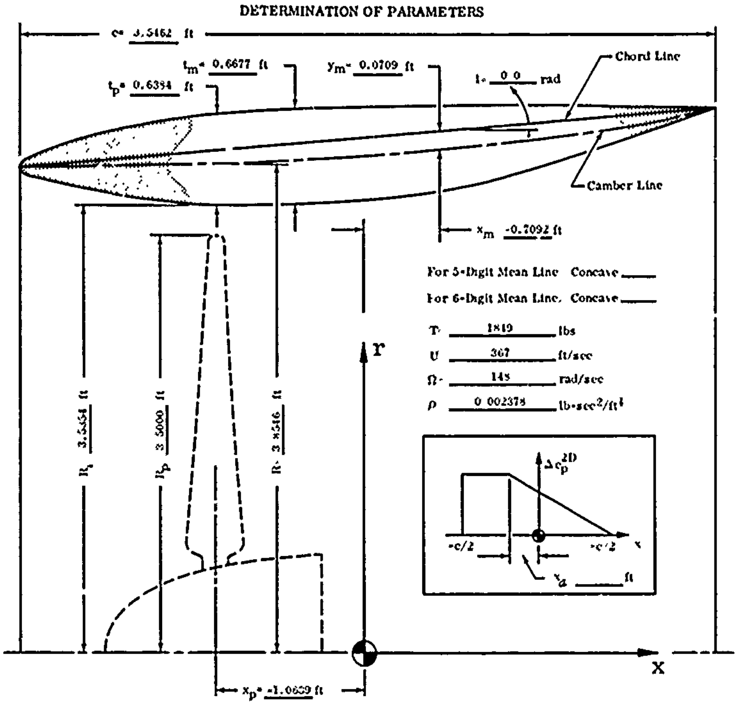


FIGURE 3

GEOMETRY COMPARISON OF
ACTUAL AND "REASONABLY APPROXIMATE" CONFIGURATIONS

(See Figs. 1, 2, 4 and 5 for comparison of various coefficients.)

SUB-PROCEDURE 1
DETERMINATION OF PARAMETERS



GROSS GEOMETRIC AND FLIGHT PARAMETERS

PARAMETER	ACTUAL	EVALUATED
$C_T = T/\frac{1}{2}\rho U^2 \pi R_i^2$	0.300	0.300
N	3	3
$e = R_p/R_i$	0.990	0.990
$\chi = x_p/c$	-0.30	-0.30
$\mu = R_p/R$	0.908	0.908
$\lambda = c/2R$	0.46	0.46
$J = U/\Omega R_p$	0.71	0.71

THICKNESS PARAMETERS

PARAMETER	ACTUAL	EVALUATED
NACA AIRFOIL SECTION	4-DIGIT	4-DIGIT
t_m/c	0.1883	0.1883

GEOMETRIC CAMBER PARAMETERS

PARAMETER	ACTUAL	EVALUATED
NACA MEAN LINE	4-DIGIT	4-DIGIT
$p = x_m/c$	-0.200	-0.200
$m = y_m/c$	0.020	0.020
$a = x_a/c$	X	X
c_{l_i}	X	X
21	0.0	0.0

COMPUTATION OF T

① 4 = 2 + 3
5 = 1 × 4

ν	1	2	3	4
0	1.4239	0.1883	1	0.1883
1	-3.1517			↓
2	-1.6826			
3	2.6810			
4	-5.2139			
5	0			
6	0			

6	7	8	9	10	11	12	13
0.7634	0.2681	0.3666	-0.5934	0	-0.3165	0.0257	0.5426
-0.2101	↓	0	↓	0.0166	↓	0	↓
0.0241		0.0512		0		-0.0019	
-0.0051		0		-0.0092		0	
0.0024		0.0048		0		0.0019	
-0.0012		0		-0.0013		0	
0.0007		0.0014		0		0.0004	

④ 29 = 27 × 28
33 = 31 × 32
36 = 29 + 30
37 = 33 × 35
38 = 34 × 35
39 = 36 + 37 + 38

ν	27	28	29	30	31	32	33
0	0.972	0.020	0.020	0.0	-0.207	0.300	-0.062
1	-8.659	↓	-0.173	0	0.129	↓	0.039
2	-2.964		-0.059	↓	-0.025		-0.008
3	-1.185		-0.024		-0.048		-0.014
4	0.024		0.000		-0.023		-0.007
5	0.405		0.008		0.0[illegible]		0.000
6	0.223		0.004		0.009		0.003
7	-0.070		-0.001		0.006		0.002
8	-0.167		-0.003		0.001		0.000
9	-0.065		-0.001		-0.002		-0.001
10	0.061		0.001		-0.002		-0.001
11	0.086		0.002		-0.001		0.000
12	0.014		0.000		0.000		0.000

40	41	42	43	44	45	46	47
1.0705	0.081	0	-0.136	0.0356	-0.026	0	-0.012
0.1516	↓	1.0823	↓	0.0050	↓	-0.0116	↓
0.0230		0		1.0150		0	
-0.0008		-0.0039		0.0000		1.0052	
-0.0001		0		-0.0018		0	
0.0000		0.0000		0.0000		-0.0010	
0.0000		0		0.0000		0	

SUB-PROCEDURE 3
COMPUTATION OF SHROUD SECTIONAL RADIAL FORCE AND MOMENT COEFFICIENTS AND CENTER OF PRESSURE

① Write the first three elements of COLUMN 61 as the element of COLUMNS 62, 63 and 64 respectively.

62	63	64
0.056	-0.135	-0.025

② 66 = 62 × 65
68 = 63 × 67
c_z = 69 = 66 + 68

	65	66
-π	-3.1416	-0.270

	67	68	69
-π/2	-1.5708	0.212	-0.058

③ 71 = 63 × 70
73 = 64 × 72
c_m = 74 = 71 + 73

	70	71
-π/8	-0.3927	0.053

	72	73	74
π/8	0.39 7	-0.010	0.043

④ 75 = 74 ÷ 69
x_{cp}/c = 77 = 75 + 76

75	76	77
-0.741	-0.250	-0.991

C

① Write the elements of COLUMN 5 as the elements of COLUMN 79.

② Write the elements of COLUMN 33, corresponding to ν = 1, 2, 3 ... 11, as the corresponding elements of COLUMN 83.

③ Write the elements of COLUMN 33, corresponding to ν = 2, 3, 4 ... 12, as the corresponding elements of COLUMN 86.

④ Write the first element of COLUMN 33, corresponding to ν = 0, as the element of COLUMN 89.

⑤ Write the second element of COLUMN 33, corresponding to ν = 1, as the element of COLUMN 90.

⑥ Write the elements of COLUMN 61, corresponding to ν = 2, 3, 4 ... 12, as the corresponding elements of COLUMN 81.

⑦ Write the elements of COLUMN 61, corresponding to ν = 1, 2, 3 ... 11, as the corresponding elements of COLUMN 87.

⑧ Write the first element of COLUMN 61, corresponding to ν = 0, as the element of COLUMN 91.

⑨ Write the second element of COLUMN 61, corresponding to ν = 1, as the element of COLUMN 92.

⑩ 80 = 78 × 79
82 = 80 × 81
85 = 83 × 84
88 = 86 × 87

⑪ 94 = 89 × 91
96 = 89 × 92
98 = 90 × 92
100 = Algebraic sum of 85

ν	78
0	0.02[illegible]
1	0.070
2	0.01[illegible]
3	0.002
4	0.002
5	0.000
6	0.000

89	90
-0.062	0.039

93	94
4.000	-0.005

	101	102
π/8	0.3927	0.001

110	111
-4.000	0.908

FIGURE 4

COMPLETED WORKSHEET I FOR "EXACT" EVALUATION OF

I

SUB-PROCEDURE 2
COMPUTATION OF THREE-DIMENSIONAL GLAUERT COEFFICIENTS OF EFFECTIVE CAMBER

ν	1	2	3	4	5
0	1.4239	0.1883	1	0.1883	0.2681
1	-3.1513				-0.5934
2	-1.6826				-0.3168
3	2.8916				0.5426
4	-5.2139				-0.9818
5	0				0
6	0				0

(2) Write the elements of COLUMN 5 as the first element of COLUMNS 7, 9, 11, 13, 15, 17 and 19 respectively.

(3)
20 = 6 × 7
21 = 8 × 9
22 = 10 × 11
23 = 12 × 13
24 = 14 × 15
25 = 16 × 17
26 = 18 × 19
34 - 20 + 21 + 22 + 23 + 24 + 25 + 26

10	11	12	13	14	15	16	17	18	19
0	-0.3168	0.0257	0.5426	0	-0.9818	0.0027	0	0	0
0.0466		0		0.0053		0		0.0003	
0		-0.0019		0		-0.0004		0	
-0.0092		0		-0.0002		0		0.0003	
0		0.0019		0		0.0001		0	
-0.0013		0		-0.0004		0		0.0000	
0		0.0004		0		0.0001		0	

20	21	22	23	24	25	26
0.2047	-0.2175	0	0.0139	0	0	0
-0.0563	0	-0.0148	0	-0.0052	0	0
0.0065	-0.0104	0	-0.0010	0	0	0
-0.0014	0	0.0029	0	0.0002	(	0
0.0006	-0.0128	0	0.0010	0	0	0
-0.0003	(	0.0004	0	0.0004	0	0
0.0002	-0.0)08	0	0.0002	0	0	0

29	30	31	32	33	34	35	36	37	38	39	ν
0.020	0.0	-0.207	0.300	-0.062	0.001	-1	0.020	0.062	-0.001	0.081	0
-0.173	0	0.129		0.039	-0.076		-0.173	-0.039	0.076	-0.136	1
-0.039		-0.025		-0.008	-0.025		-0.039	0.008	0.023	-0.026	2
-0.024		-0.048		-0.014	0.002		-0.024	0.014	-0.002	-0.012	3
0.000		-0.023		-0.007	-0.001		0.000	0.007	0.001	0.008	4
0.008		0.001		0.000	0.001		0.008	0.000	-0.001	0.007	5
0.004		0.009		0.003	0.000		0.064	-0.003	0.000	0.001	6
-0.001		0.006		0.002	0		-0.001	-0.002	0	-0.003	7
-0.003		0.001		0.000			-0.003	0.000	0	-0.003	8
-0.001		-0.002		-0.001			-0.001	0.001	0	0.000	9
0.001		-0.002		-0.001			0.001	0.001	0	0.002	10
0.002		-0.001		0.000			0.002	0.000	0	0.002	11
0.000		0.000		0.000			0.000	0.000	0	0.000	12

(5) Write the first seven elements of COLUMN 39 as the first element of COLUMNS 41, 43, 45, 47, 49, 51 and 53 respectively.

(6)
54 = 40 × 41
55 = 42 × 43
56 = 44 × 45
57 = 46 × 47
58 = 48 × 49
59 = 50 × 51
60 = 52 × 53

44	45	46	47	48	49	50	51	52	53
0.0356	-0.026	0	-0.012	-0.0002	0.008	0	0.007	0.0000	0.001
0.0050		-0.0116		0.0000		0.0001		0.0000	
1.0150		0		-0.0035		0		0.0000	
0.0000		1.0032		0.0000		-0.0017		0.0000	
-0.0018		0		1.0027		0		-0.0010	
0.0000		-0.0010		0.0000		1.0017		0.0000	
0.0000		0		-0.0007		0		1.0011	

54	55	56	57	58	59	60
0.0867	0	-0.0009	0	0.0000	0	0.0000
0.0123	-0.1472	-0.0001	0.0001	0.0000	0.0000	0.0000
0.0019	(	-0.0264	0	0.0000	0	0.0000
-0.0001	0.0)05	0.0000	-0.0121	0.0000	0.0000	0.0000
0.0000	0	0.0000	0	0.00-0	0	0.0000
0.0000	0.0)00	0.0000	0.0000	0.0000	0.0070	0.0000
0.0000	0	0.0000	0	0.0000	0	0.0010

ν	61
0	0.056
1	-0.135
2	-0.025
3	-0.012
4	0.008
5	0.007
6	0.001
7	-0.003
8	-0.003
9	0.000
10	0.002
11	0.002
12	0.000

(7) $c_\nu^{3D} = 61 = 54 + 55 + 56 + 57 + 58 + 59 + 60$; $\nu = 0, 1, 2 \ldots 6$

$c_\nu^{3D} = 61 = 39$; $\nu = 7, 8, 9 \ldots 12$

SUB-PROCEDURE 4
COMPUTATION OF SHROUD THRUST COEFFICIENT

...6 as the elements of COLUMN 79.

(7) Write the elements of COLUMN 61, corresponding to $\nu = 1, 2, 3 \ldots 11$, as the corresponding elements of COLUMN 87.

(8) Write the first element of COLUMN 61, corresponding to $\nu = 0$, as the element of COLUMN 91.

(9) Write the second element of COLUMN 61, corresponding to $\nu = 1$, as the element of COLUMN 92.

ν	78	79	80	81	82
0	0.028	0.2681	0.0075	0.300	0.002
1	0.170	-0.5934	-0.0415		-0.012
2	0.016	-0.3168	-0.0051		-0.002
3	0.002	0.5426	0.0011		0.000
4	0.002	-0.9818	-0.0020		-0.001
5	0.000	0	0		0
6	0.000	0	0		0

ν	83	ν	84	85	ν	86	ν	87	88
1	0.039	2	-0.025	-0.001	2	-0.008	1	-0.135	0.001
2	-0.008	3	-0.012	0.000	3	-0.014	2	-0.025	0.000
3	-0.014	4	0.008	0.000	4	-0.007	3	-0.012	0.000
4	-0.007	5	0.007	0.000	5	0.000	4	0.008	0.000
5	0.000	6	0.001	0.000	6	0.003	5	0.007	0.000
6	0.003	7	-0.003	0.000	7	0.002	6	0.001	0.000
7	0.002	8	-0.003	0.000	8	0.000	7	-0.003	0.000
8	0.000	9	0.000	0.000	9	-0.001	8	-0.003	0.000
9	-0.001	10	0.002	0.000	10	-0.001	9	0.000	0.000
10	-0.001	11	0.002	0.000	11	0.000	10	0.002	0.000
11	0.000	12	0.000	0.000	12	0.000	11	0.002	0.000

89	90	91	92
-0.062	0.039	0.056	-0.13'

93	94	95	96	97	98	99	100
4.000	-0.005	2.000	0.005	-2.000	-0.005	-1	-0.001

π/8 →

101	102	103	104	105	106	107	108	109
0.3927	0.001	-0.020	0.016	0.010	0.001	0.008	0.003	-0.013

...raic sum of 85

110	111	112	113	114	115	116	117
-4.000	0.908	0.46	-4.4053	0.5066	-2.2317	-0.010	0.022

(12)
102 = Algebraic sum of 88
103 = 93 × 94
104 = 95 × 96
105 = 97 × 98
106 = 99 × 100
107 = 102 + 103 + 104 + 105 + 106
108 = 101 × 107
109 = Algebraic sum of 82

(13)
113 = 110 + 111
114 = 112 + 111
115 = 113 × 114
116 = 108 + 109

C_ℓ = 117 = 115 × 116

IGURE 4

F'' EVALUATION OF ACTUAL CONFIGURATION

2

SUB-PROCEDURE 5
COMPUTATION OF NET SHROUD PRESSURE COEFFICIENTS

(1) Write the elements of COLUMN 61 on WORKSHEET I as the first element of COLUMNS 119, 121, 123, 125, 127, 129, 131, 133, 135, 137, 139, 141 and 143 respectively.

118	119	120	121	122	123	124	125	126	127	128	129	130	131
∞	0.086	0	-0.135	0	-0.025	0	-0.012	0	0.008	0	0.007	0	0.001
3.0000		0.6000		0.9600		0.9360		0.5376		-0.0758		-0.6589	
2.0000		0.8000		0.9600		0.3520		-0.5376		-0.9971		-0.6589	
1.5275		0.9165		0.7332		-0.3300		-0.9972		-0.4678		0.6229	
1.2248		0.9798		0.3919		-0.8230		-0.7211		0.5346		0.9350	
1.0000		1.0000		0		-1.0000		0		1.0000		0	
0.8165		0.9798		-0.3919		-0.8230		0.7211		0.5346		-0.9350	
0.6547		0.9165		-0.7332		-0.3300		0.9972		-0.4678		-0.6229	
0.5000		0.8000		-0.9600		0.3520		0.5376		-0.9971		0.6589	
0.3333		0.6000		-0.9600		0.9360		-0.5376		-0.0758		0.6589	
0		0		0		0		0		0		0	

(2) 144 = 118 × 119
145 = 120 × 121
146 = 122 × 123
147 = 124 × 125
148 = 126 × 127
149 = 128 × 129
150 = 130 × 131

144	145	146	147	148	149	150	151	152	153	154	155	156	157	158
∞	0	0	0	0	0	0	0	0	0	0	0	0	∞	-2.000
0.2580	-0.0810	-0.0240	-0.0112	0.0043	-0.0005	-0.0007	0.0029	0.0027	0.0000	0.0003	0.0014	0.0000	0.152	
0.1720	-0.1080	-0.0240	-0.0042	-0.0043	-0.0070	-0.0007	-0.0006	-0.0027	0.0000	0.0003	-0.0014	0.0000	0.019	
0.1314	-0.1237	-0.0183	0.0040	-0.0080	-0.0033	0.0006	-0.0029	-0.0005	0.0000	-0.0017	0.0004	0.0000	-0.022	
0.1053	-0.1323	-0.0098	0.0099	-0.0058	0.0037	0.0009	0.0005	0.0030	0.0000	0.0018	0.0012	0.0000	-0.022	
0.0860	-0.1350	0	0.0120	0	0.0070	0	0.0030	0	0.0000	0	-0.0020	0	-0.029	
0.0702	-0.1323	0.0098	0.0099	0.0058	0.0037	-0.0009	0.0005	-0.0030	0.0000	-0.0018	0.0012	0.0000	-0.037	
0.0563	-0.1237	0.0183	0.0040	0.0080	-0.0033	-0.0006	-0.0029	0.0005	0.0000	0.0017	0.0004	0.0000	-0.041	
0.0430	-0.1080	0.0240	-0.0042	0.0043	-0.0070	0.0007	-0.0006	0.0027	0.0000	-0.0003	-0.0014	0.0000	-0.047	
0.0287	-0.0810	0.0240	-0.0112	-0.0043	-0.0005	0.0007	0.0029	-0.0027	0.0000	-0.0003	0.0014	0.0000	-0.042	
0	0	0	0	0	0	0	0	0	0	0	0	0	0	

x/c	159
-0.5	-∞
-0.4	-0.304
-0.3	-0.038
-0.2	0.044
-0.1	0.044
0.0	0.058
0.1	0.074
0.2	0.082
0.3	0.094
0.4	0.084
0.5	0

SUB-PROCEDURE 6
COMPUTATION OF OUTER AND INNER SHROUD SURFACE PRESSURE COEFF

(1) Write the first seven elements of COLUMN 61 on WORKSHEET I as the first element of COLUMNS 161, 163, 165, 167, 169, 171 and 173 respectively.

160	161	162	163	164	165	166	167	168	169	170	171	172	173	174	175	176	177
1.1501	0.086	0.5764	-0.135	0	-0.025	-0.0014	-0.012	0	0.008	0.0000	0.007	0	0.001	0.0218	0.2681	0	-0.5934
-0.4759		0		-0.2387		0		0.0009		0		0.0000		0.0651		0.0378	
0.0055		0.1194		0		-0.1169		0		0.0002		0		0.0125		0	
0.0017		0		0.0779		0		-0.0772		0		0.0001		-0.0009		-0.0019	
0.0000		-0.0002		0		0.0579		0		-0.0577		0		0.0000		0	
0.0000		0		-0.0001		0		0.0461		0		-0.0461		0.0000		-0.0001	
0.0000		0.0000		0		-0.0001		0		0.0384		0		0.0000		0	

(3) 188 = 160 × 161
189 = 162 × 163
190 = 164 × 165
191 = 166 × 167
192 = 168 × 169
193 = 170 × 171
194 = 172 × 173

188	189	190	191	192	193	194	195	196	197	198	199	200	201	202	203	204
0.0989	-0.0778	0	0.0000	0	0.0000	0	0.0058	0	0.0016	0	0.0006	0	0	0.029	-1	-0.029
-0.0409	0	0.0060	0	0.0000	0	0.0000	0.0183	-0.0224	0	0.0011	0	0	0	-0.038		0.039
0.0005	-0.0161	0	0.0014	0	0.0000	0	0.0034	0	0.0009	0	0.0003	0	0	-0.010		0.010
0.0001	0	-0.0019	0	-0.0006	0	0.0000	-0.0002	0.0011	0	0.0001	0	0	0	-0.001		0.001
0.0000	0.0000	0	-0.0007	0	-0.0004	0	0.0000	0	0.0000	0	0.0000	0	0	-0.001		0.001
0.0000	0	0.0000	0	0.0004	0	-0.0001	0.0000	0.0001	0	-0.0001	0	0	0	0.000		0.000
0.0000	0.0000	0	0.0000	0	0.0003	0	0.0000	0	0.0000	0	0.0000	0	0	0.000		0.000

(4)

(6) Write the elements of COLUMN 204 as the first element of COLUMNS 206, 208, 210, 212, 214, 216 and 218 respectively.

205	206	207	208	209	210	211	212	213	214	215	216
0.5000	-0.029	-0.5000	0.039	-0.5000	0.010	-0.5000	0.001	-0.5000	0.001	-0.5000	0.000
0.5000		-0.4000		-0.1400		0.1760		0.3816		0.4996	
0.5000		-0.3000		0.1400		0.4680		0.4216		0.0379	
0.5000		-0.2000		0.3400		0.4720		0.0376		-0.4419	
0.5000		-0.1000		0.4600		0.2840		-0.3464		-0.4226	
0.5000		0		0.5000		0		-0.5000		0	
0.5000		0.1000		0.4600		-0.2840		-0.3464		0.4226	
0.5000		0.2000		0.3400		-0.4720		0.0376		0.4419	
0.5000		0.3000		0.1400		-0.4680		0.4216		-0.0379	
0.5000		0.4000		-0.1400		-0.1760		0.3816		-0.4986	
0.5000		0.5000		-0.5000		0.5000		-0.5000		0.5000	

(8) 230 = 228 + 229

Write the element of COLUMN 230 as the second element of COLUMN 232

For NACA 4- or 5-digit airfoil sections, write the value 1.000 in the last element of COLUMN 232

OR

For NACA 6-digit airfoil sections, write the element of COLUMN 230 as the last element of COLUMN 232

233 = 231 × 232
235 = 233 + 234
236 = 233 × 235
241 = 236 + 234

226	227	228	229	230	231	232	233	234	235	236	237	238	239	240	241	242
-0.128	0.300	0.1883	0.18	1.046	2.000	1.000	2.000	-4.000	-2.000	-4.000	-1	∞	-0.040	0.038	1.000	∞
-0.096					-0.552	1.046	-0.577		-4.577	2.641		0.152	-0.031	-0.029	-0.660	-0.152
0					-0.550		-0.575		-4.575	2.631		0.019	-0.024	0	-0.658	-0.019
0.096					-0.494		-0.517		-4.517	2.335		-0.022	-0.018	0.029	-0.544	0.022
0.128					-0.410		-0.429		-4.429	1.900		-0.022	-0.014	0.035	-0.475	0.022
0.132					-0.308		-0.322		-4.322	1.392		-0.029	-0.010	0.040	-0.344	0.029
0.127					-0.232		-0.243		-4.243	1.031		-0.037	-0.007	0.038	-0.258	0.037
0.119					-0.148		-0.155		-4.155	0.644		-0.041	-0.004	0.036	-0.161	0.041
0.111					-0.050		-0.052		-4.052	0.211		-0.047	-0.002	0.033	-0.053	0.047
0.102					0.068		0.071		-3.929	-0.279		-0.042	-0.001	0.031	0.070	0.042
0.094					2.000	1.000	2.000		-2.000	-4.000		0	-0.001	0.028	1.000	0

x/c	243
-0.5	∞
-0.4	-0.554
-0.3	-0.663
-0.2	-0.595
-0.1	-0.473
0.0	-0.347
0.1	-0.264
0.2	-0.170
0.3	-0.069
0.4	0.058
0.5	1.027

FIGURE 5

COMPLETED WORKSHEET II FOR "EXACT" EVALUATION

II

5
COEFFICIENTS

130	131	132	133	134	135	136	137	138	139	140	141	142	143
0	0.001	0	-0.003	0	-0.003	0	0.000	0	0.402	0	0.002	0	0.000
-0.6589	↓	-0.9785	↓	-0.9066	↓	-0.4721	↓	0.1513	↓	0.7141	↓	0.9913	↓
-0.6589		0.2064		0.9066		0.8816		0.1513		-0.7000		-0.9913	
0.6229		0.9661		0.1500		-0.8462		-0.8269		0.1847		0.9746	
0.9350		-0.1606		-0.9992		-0.2391		0.8959		0.6005		-0.6646	
0		-1.0000		0		1.0000		0		-1.0000		0	
-0.9350		-0.1606		0.9992		-0.2391		-0.8959		0.6005		0.6646	
-0.6229		0.9661		-0.1500		-0.8462		0.8269		0.1847		-0.9746	
0.6589		0.2064		-0.9066		0.8816		-0.1513		-0.7000		0.9913	
0.6589		-0.9785		0.9066		-0.4721		-0.1513		0.7141		-0.9913	
0		0		0		0		0		0		0	

158
0.000
↓

x/c	159
-0.5	-∞
-0.4	-0.304
-0.3	-0.038
-0.2	0.044
-0.1	0.044
0.0	0.058
0.1	0.074
0.2	0.082
0.3	0.094
0.4	0.084
0.5	0

+ −

(3) 151 = 132 × 133
152 = 134 × 135
153 = 136 × 137
154 = 138 × 139
155 = 140 × 141
156 = 142 × 143
157 = 144 + 145 + 146 + 147 + 148 + 149 + 150 + 151 + 152 + 153 + 154 + 155 + 156

Δc_p = 159 = 157 × 158

6
ACE PRESSURE COEFFICIENTS

176	177	178	179	180	181	182	183	184	185	186	187
0	-0.5934	-0.0049	-0.3168	0	0.5426	-0.0006	-0.9518	0	0	-0.0001	0
0.0378	↓	0	↓	0.0020	↓	0	↓	0.0002	↓	0	↓
0		-0.0025		0		-0.0003		0		0.0000	
-0.0019		0		0.0001		0		0.0000		0	
0		0.0000		0		0.0000		0		0.0000	
-0.0001		0		-0.0001		0		0.0000		0	
0		0.0000		0		0.0000		0		0.0000	

(2) Write the elements of COLUMN 5 on WORKSHEET I as the first element of COLUMNS 175, 177, 179, 181, 183, 185 and 187 respectively.

203	204
-1	-0.029
↓	0.035
	0.010
	0.001
	0.001
	0.000
	0.000

(4) 195 = 174 × 175
196 = 176 × 177
197 = 178 × 179
198 = 180 × 181
199 = 182 × 183
200 = 184 × 185
201 = 186 × 187

(5) 202 = 188 + 189 + 190 + 191 + 192 + 193 + 194 + 195 + 196 + 197 + 198 + 199 + 200 + 201
204 = 202 × 203

215	216	217	218
-0.5000	0.000	-0.5000	0.000
0.4986	↓	0.3761	↓
0.0379		-0.3761	
-0.4419		-0.3911	
-0.4226		0.1774	
0		0.5000	
0.4226		0.1774	
0.4419		-0.3911	
-0.0379		-0.3761	
-0.4986		0.3761	
0.5000		-0.5000	

219	220	221	222	223	224	225
-0.0145	-0.0190	-0.0050	-0.0005	-0.0005	0.0000	0.0000
-0.0145	-0.0152	-0.0014	0.0002	0.0004	0.0000	0.0000
-0.0145	-0.0114	0.0014	0.0005	0.0004	0.0000	0.0000
-0.0145	-0.0076	0.0034	0.0005	0.0000	0.0000	0.0000
-0.0145	-0.0035	0.0046	0.0003	-0.0003	0.0000	0.0000
-0.0145	0	0.0050	0	-0.0005	0	0.0000
-0.0145	0.0035	0.0046	-0.0003	-0.0003	0.0000	0.0000
-0.0145	0.0076	0.0034	-0.0005	0.0000	0.0000	0.0000
-0.0145	0.0114	0.0014	-0.0005	0.0004	0.0000	0.0000
-0.0145	0.0152	-0.0014	-0.0002	0.0004	0.0000	0.0000
-0.0145	0.0190	-0.0050	0.0005	-0.0005	0.0000	0.0000

(7) 219 = 205 × 206
220 = 207 × 208
221 = 209 × 210
222 = 211 × 212
223 = 213 × 214
224 = 215 × 216
225 = 217 × 218

242
-∞
0.152
0.019
0.022
0.022
0.029
0.037
0.041
0.047
0.042
0

x/c	243	244
-0.5	∞	-∞
-0.4	-0.568	-0.872
-0.3	-0.663	-0.701
-0.2	-0.595	-0.551
-0.1	-0.473	-0.429
0.0	-0.347	-0.289
0.1	-0.261	-0.190
0.2	-0.170	-0.058
0.3	-0.069	0.025
0.4	0.035	0.142
0.5	1.027	1.027

+ −

(9) Write the elements of COLUMN 157 as the corresponding elements of COLUMN 235.

239 = 219 + 220 + 221 + 222 + 223 + 224 + 225
240 = 226 × 227
242 = 237 × 238

c_p (OUTER) = 243 = 238 + 239 + 240 + 241
c_p (INNER) = 244 = 239 + 240 + 241 + 242 } QUADRATIC

c_p (OUTER) = 243 = 233 + 238 + 239 + 240
c_p (INNER) = 244 = 233 + 239 + 240 + 242 } LINEAR

the shroud outer and inner surface pressure coefficients for the two cases may be found from Figs. 1 and 4 and Figs. 2 and 5, respectively. The overall numerical agreement indicates roughly the level of confidence which can be attached to the use of the evaluation procedure for "reasonably approximate" configurations. In general, it appears that we obtain a satisfactory engineering estimate.

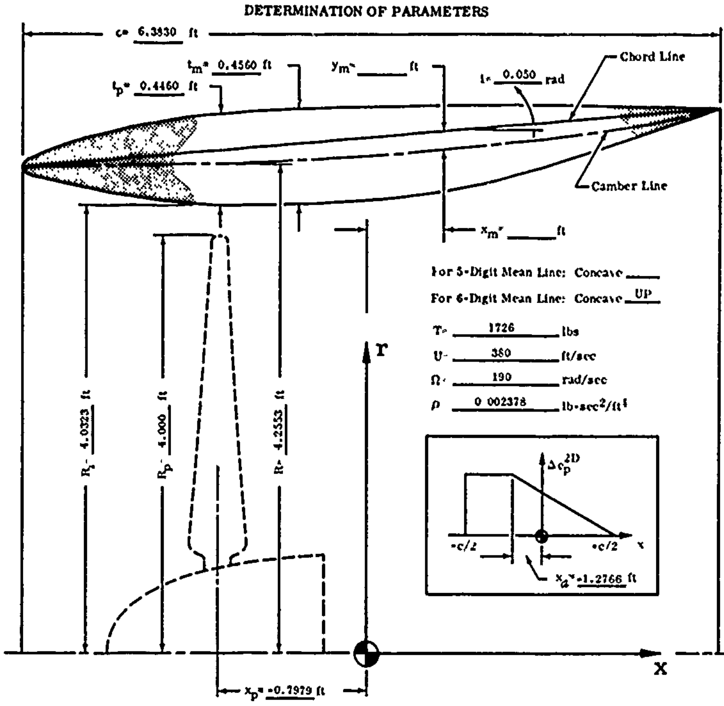
2.3 Example for Interpolation/Extrapolation

The second example is the computation of the outer and inner shroud surface distributions for a "non-exact" configuration. Arbitrarily, the parameters of the actual configuration correspond to the tabulated values of the parameters with the exception of the propeller plane position. Its value of -0.125 is such that it lies midway between two tabulated values.

For this case, three evaluations were performed with $x = -0.25$, 0.0 and 0.25, the corresponding values of t_p being 0.3979 ft, 0.4537 ft, and 0.2969 ft. The results for the actual configuration were then obtained by three-point Lagrangian interpolation of this data. Figs. 6 and 7 are the completed worksheets for $x = 0.25$.

An "exact" evaluation has also been run using the general computer programs. The two results are presented in Fig. 8 along with

SUB-PROCEDURE 1
DETERMINATION OF PARAMETERS



GROSS GEOMETRIC AND FLIGHT PARAMETERS

PARAMETER	ACTUAL	EVALUATED
$C_T = T/\frac{1}{2}\rho U^2 \pi R_p^2$	0.200	0.200
N	4	4
$e = R_p/R_i$	0.992	0.992
$X = x_p/c$	-0.125	0.25
$\mu = R_p/R$	0.940	0.940
$\lambda = c/2R$	0.75	0.75
$J = U/\Omega R_p$	0.50	0.50

THICKNESS PARAMETERS

PARAMETER	ACTUAL	EVALUATED
NACA AIRFOIL SECTION	6-DIGIT OF FAMILY	6-DIGIT OF FAMILY
t_m/c	0.0714	0.1074

GEOMETRIC CAMBER PARAMETERS

PARAMETER	ACTUAL	EVALUATED
NACA MEAN LINE	6-DIGIT	6-DIGIT
$p = x_m/c$	X	X
$m = y_m/c$	X	X
$a = x_a/c$	-0.200	-0.200
c_{l_i}	-0.200	-0.200
21	0.100	0.100

COMPUTATION OF TH

(1) 4 = 2 + 3; 5 = 1 × 4

ν	1	2	3	4
0	0.0815	0.1074	0.0600	1.790
1	-0.1115			
2	-0.2200			
3	-0.2919			
4	-0.2513			
5	0.5258			
6	1.1284			

6	7	8	9	10	11	12	13
0.7784	0.1459	0.4770	-0.1996	0	-0.3938	0.0893	-0.5225
-0.2693		0		0.1244		0	
0.0289		0.0835		0		-0.0091	
-0.0054		0		-0.0252		0	
0.0032		0.0077		0		0.0085	
-0.0016		0		-0.0033		0	
0.0008		0.0022		0		0.0015	

(4) 29 = 27 × 28; 33 = 31 × 32; 36 = 29 + 30; 37 = 33 × 35; 38 = 34 × 35; 39 = 36 + 37 + 38

ν	27	28	29	30	31	32	33
0	0.134	-0.200	-0.027	0.100	-0.169	0.200	-0.034
1	-0.637		0.127	0	-0.117		-0.023
2	-0.366		0.073		-0.053		-0.011
3	-0.130		0.026		0.077		0.015
4	-0.107		0.021		-0.027		-0.005
5	-0.090		0.018		-0.019		-0.004
6	-0.090		0.018		0.029		0.006
7	-0.075		0.015		-0.010		-0.002
8	-0.062		0.012		-0.009		-0.002
9	-0.050		0.010		0.013		0.003
10	-0.047		0.009		-0.005		-0.001
11	-0.045		0.009		-0.005		-0.001
12	-0.043		0.009		0.007		0.001

40	41	42	43	44	45	46	47
1.1398	0.107	0	0.223	0.0704	0.098	0	0.000
0.3166		1.1722		0.0197		-0.0329	
0.0650		0		1.0425		0	
-0 0022		-0.0110		-0.0001		1.0147	
-0.0008		0		-0.0051		0	
0.0000		0.0001		0.0000		-0.0028	
0.0000		0		0.0000		0	

SUB-PROCEDURE 3
COMPUTATION OF SHROUD SECTIONAL RADIAL FORCE AND MOMENT COEFFICIENTS AND CENTER OF PRESSURE

(1) Write the first three elements of COLUMN 61 as the element of COLUMNS 62, 63 and 64 respectively.

62	63	64
0.129	0.297	0.109

(2) 66 = 62 × 65; 68 = 63 × 67

c_z = 69 = 66 + 68

-π —

65	66
-3.1416	-0.405

-π/2 —

67	68	69
-1.5708	-0.467	-0.872

(3) 71 = 63 × 70; 73 = 64 × 72

c_m = 74 = 71 + 73

-π/8 —

70	71
-0.3927	-0.117

π/8 —

72	73	74
0.3927	0.043	-0.074

(4) 75 = 74 ÷ 69

x_{cp}/c = 77 = 75 + 76

75	76	77
0.085	0.250	-0.165

CO

(1) Write the elements of COLUMN 5 as the elements of COLUMN 79.

(2) Write the elements of COLUMN 33, corresponding to ν=1,2,3 ... 11, as the corresponding elements of COLUMN 83.

(3) Write the elements of COLUMN 33, corresponding to ν=2,3,4 ... 12, as the corresponding elements of COLUMN 86.

(4) Write the first element of COLUMN 33, corresponding to ν = 0, as the element of COLUMN 89.

(5) Write the second element of COLUMN 33, corresponding to ν = 1, as the element of COLUMN 90.

(6) Write the elements of COLUMN 61, corresponding to ν=2,3,4 ... 12, as the corresponding elements of COLUMN 84.

(7) Write the elements of COLUMN 61, corresponding to ν=1,2,3 ... 11, as the corresponding elements of COLUMN 87.

(8) Write the first element of COLUMN 61, corresponding to ν = 0, as the element of COLUMN 91.

(9) Write the second element of COLUMN 61, corresponding to ν = 1, as the element of COLUMN 92.

(10) 80 = 78 × 79; 82 = 80 × 81; 85 = 83 × 84; 88 = 86 × 87

(11) 94 = 89 × 91; 96 = 89 × 92; 98 = 90 × 92; 100 = Algebraic sum of 85

ν	78
0	-0.111
1	-0.051
2	0.030
3	0.002
4	0.011
5	0.002
6	0.004

89	90
-0.034	-0.023

93	94
4.000	-0.004

π/8 —

101	102
0.3927	-0.001

110	111
-4.000	0.910

FIGURE 6

COMPLETED WORKSHEET I FOR INTERPOLATION/EXTRAPO

I

SUB-PROCEDURE 2

COMPUTATION OF THREE-DIMENSIONAL GLAUERT COEFFICIENTS OF EFFECTIVE CAMBER

2	3	4	5
0.1074	0.0600	1.790	0.1459
			-0.1996
			-0.3938
			-0.5225
			-0.4498
			0.9412
			2.0198

(2) Write the elements of column 5 as the first element of columns 7, 9, 11, 13, 15, 17 and 19 respectively.

(3) 20 = 6 × 7
21 = 8 × 9
22 = 10 × 11
23 = 12 × 13
24 = 14 × 15
25 = 16 × 17
26 = 18 × 19
34 = 20 + 21 + 22 + 23 + 24 + 25 + 26

12	13	14	15	16	17	18	19
0.0593	-0.5225	0	-0.4498	0.0301	0.9412	0	2.0198
0		0.0418		0		0.0168	
-0.0091		0		-0.0066		0	
0		-0.0023		0		0.0005	
0.0085		0		0.0021		0	
0		-0.0032		0		-0.0012	
0.0015		0		0.0013		0	

20	21	22	23	24	25	26
0.1136	-0.0952	0	-0.0467	0	0.0283	0
-0.0393	0	-0.0490	0	-0.0188	0	0.0339
0.0042	-0.0167	0	0.0048	0	-0.0062	0
-0.0008	0	0.0099	0	0.0010	0	0.0010
0.0003	-0.0015	0	-0.0044	0	0.0020	0
-0.0002	0	0.0013	0	0.0014	0	-0.0024
0.0001	-0.0004	0	-0.0008	0	0.0012	0

31	32	33	34	35	36	37	38	39	ν
-0.169	0.200	-0.034	0.000	-1	0.073	0.034	0.000	0.107	0
-0.117		-0.023	-0.073		0.127	0.223	0.073	0.223	1
-0.053		-0.011	-0.014		0.073	0.011	0.014	0.098	2
0.077		0.015	0.011		0.026	-0.015	-0.011	0.000	3
-0.027		-0.005	-0.003		0.021	0.005	0.003	0.029	4
-0.019		-0.004	0.000		0.018	0.004	0.000	0.022	5
0.029		0.006	0.000		0.018	-0.006	0.000	0.012	6
-0.010		-0.002	0		0.015	0.002	0	0.017	7
-0.009		-0.002			0.012	0.002	0	0.014	8
0.013		0.003			0.010	-0.003	0	0.007	9
-0.005		-0.001			0.009	0.001	0	0.010	10
-0.005		,001			0.009	0.001	0	0.010	11
0.007		0.001			0.009	-0.001	0	0.008	12

(5) Write the first seven elements of column 39 as the first element of columns 41, 43, 45, 47, 49, 51 and 53 respectively.

(6) 54 = 40 × 41
55 = 42 × 43
56 = 44 × 45
57 = 46 × 47
58 = 48 × 49
59 = 50 × 51
60 = 52 × 53

46	47	48	49	50	51	52	53
0	0.000	-0.0005	0.029	0	0.022	0.0000	0.012
-0.0329		-0.000.		0.0004		0.0000	
0		-0.0101		0		0.0001	
1.0147		0.0000		-0.0047		0.0000	
0		1.0074		0		-0.0028	
-0.0028		0.0000		1.0045		0.0000	
0		-0.0018		0		1.0031	

54	55	56	57	58	59	60
0.1220	0	0.0069	0	0.0000	0	0.0000
0.0341	0.2614	0.0019	0.0000	0.0000	0.0000	0.0000
0.0070	0	0.1022	0	-0.0003	0	0.0000
-0.0002	-0.1025	0.0000	0.0000	0.0000	-0.0001	0.0000
-0.0001	0	-0.0005	0	0.0292	0	0.0000
0.0000	0.4000	0.0000	0.0000	0.0000	0.0221	0.0000
0.0000	0	0.0000	0	-0.0001	0	0.0120

ν	61
0	0.129
1	0.297
2	0.109
3	-0.003
4	0.029
5	0.022
6	0.012
7	0.017
8	0.014
9	0.007
10	0.010
11	0.010
12	0.008

(7) $c_{\nu}^{3D} = 61 = 54 + 55 + 56 + 57 + 58 + 59 + 60$, $\nu = 0, 1, 2 \ldots 6$

$c_{\nu}^{3D} = 61 = 39$, $\nu = 7, 8, 9 \ldots 12$

SUB-PROCEDURE 4

COMPUTATION OF SHROUD THRUST COEFFICIENT

of column 79.

elements of
, corresponding
3 ... 11, as the
nding elements
87.

first element of
, corresponding to
the element of
.

second element of
, corresponding to
the element of
.

ν	78	79	80	81	82
0	-0.111	0.1459	-0.0162	0.200	-0.003
1	-0.051	-0.1996	0.0102		0.002
2	0.030	-0.3938	-0.0118		-0.002
3	0.002	-0.5225	-0.0010		0.000
4	0.011	-0.4498	-0.0049		-0.001
5	0.002	0.9412	0.0019		0.000
6	0.004	2.0198	0.0081		0.002

ν	83
1	-0.023
2	-0.011
3	0.015
4	-0.005
5	-0.004
6	0.006
7	-0.002
8	-0.002
9	0.003
10	-0.001
11	-0.001

ν	84	85
2	0.109	-0.003
3	-0.003	0.000
4	0.029	0.001
5	0.022	0.000
6	0.012	0.000
7	0.017	0.000
8	0.014	0.000
9	0.007	0.000
10	0.010	0.000
11	0.010	0.000
12	0.008	0.000

ν	86
2	-0.011
3	0.015
4	-0.005
5	-0.004
6	0.006
7	-0.002
8	-0.002
9	0.003
10	-0.001
11	-0.001
12	0.001

ν	87	88
1	0.297	-0.003
2	0.103	0.002
3	-0.003	0.000
4	0.029	0.000
5	0.022	0.000
6	0.012	0.000
7	0.017	0.000
8	0.014	0.000
9	0.007	0.000
10	0.010	0.000
11	0.010	0.000

89	90	91	92
-0.034	-0.023	0.129	0.297

93	94	95	96	97	98	99	100
4.000	-0.004	2.000	-0.010	-2.000	-0.007	-1	-0.003

π/8

101	102	103	104	105	106	107	108	109
0.3927	-0.001	-0.016	-0.020	0.014	0.003	-0.020	-0.008	-0.002

110	111	112	113	114	115	116	117
-4.000	0.910	0.75	-4.2553	0.7979	-3.3953	-0.010	0.034

(12) 102 Algebraic sum of 88
103 = 93 × 91
104 95 × 96
105 97 × 98
106 99 × 100
107 102 + 103 + 104 + 105 + 106
108 101 × 107
109 = Algebraic sum of 82

(13) 113 = 110 + 111
114 = 112 + 111
115 = 113 × 114
116 = 108 + 109

$C_{\ell} = 117 = 115 \times 116$

6

ON/EXTRAPOLATION EXAMPLE, $x = 0.25$

2

SUB-PROCEDURE 5

COMPUTATION OF NET SHROUD PRESSURE COEFFICIENTS

(1) Write the elements of COLUMN 61 on WORKSHEET I as the first element of COLUMNS 119, 121, 123, 125, 127, 129, 131, 133, 135, 137, 139, 141 and 143 respectively.

118	119	120	121	122	123	124	125	126	127	128	129	130	131	132
∞	0.129	0	0.297	0	0.109	0	-0.003	0	0.029	0	0.022	0	0.012	0
3.0000		0.6000		0.9600		0.9360		0.5376		-0.0758		-0.6589		-0.9788
2.0000		0.6000		0.9600		0.3520		-0.5376		-0.9971		-0.6589		0.2064
1.5275		0.9165		0.7332		-0.3300		-0.9972		-0.4678		0.6229		0.9661
1.2248		0.9798		0.3919		-0.8230		-0.7211		0.5346		0.9350		-0.1606
1.0000		1.0000		0		-1.0000		0		1.0000		0		-1.0000
0.8165		0.9798		-0.3919		-0.8230		0.7211		0.5346		-0.9350		-0.1606
0.6547		0.9165		-0.7332		-0.3300		0.9972		-0.4678		-0.6229		0.9661
0.5000		0.6000		-0.9600		0.3520		0.5376		-0.9971		0.6589		0.2064
0.3333		0.6000		-0.9600		0.9360		-0.5376		-0.0758		0.6589		-0.9788
0		0		0		0		0		0		0		0

(2) 144 = 118 × 119
145 = 120 × 121
146 = 122 × 123
147 = 124 × 125
148 = 126 × 127
149 = 128 × 129
150 = 130 × 131

144	145	146	147	148	149	150	151	152	153	154	155	156	157	158
∞	0	0	0	0	0	0	0	'	0	0	0	0	∞	-2.000
0.3370	0 1762	0 1046	-0.0028	0.0156	-0.0017	-0 0079	-0.0166	-0.0127	-0.0033	0.0015	0 0071	0.0079	0.657	
0.2550	0.2376	0.1046	-0.0011	-0.0156	-0.0219	-0 0079	0.0035	0.0127	0 0062	0.0015	-0.0070	-0 0079	0 563	
0 1970	0 2722	0 0799	0 0010	-0.0289	-0 0103	0.0075	0.0164	0.0021	-0 6059	-0 0083	0 0018	0 0078	0 532	
0.1580	0 2910	0 0427	0.0025	-0.0209	0 0118	0.0112	-0 0027	-0.0140	-0 0017	0.0090	0 0060	-0 0053	0 488	
0.1290	0.2970	0	0.0030	0	0.0220	0	-0.0170	0	0.0070	0	-0 0100	0	0 431	
0.1052	0.2910	-0.0427	0 0025	0.0209	0 0118	-0 0112	-0 0027	0.0140	-0 0017	-0.0090	0.0060	0 0053	0 390	
0 0845	0 2722	-0.0799	0 0010	0 0289	-0 0103	-0 0075	0.0164	-0.0021	-0.0059	0 0083	0.0018	-0.0078	0.300	
0.0645	0 2376	-0 1046	-0.0011	0.0156	-0.0219	0.0079	0.0035	-0.0127	0 0062	-0 0015	-0.0070	0 0079	0 194	
0.0430	0 1762	-0.1046	-0.0028	-0 0156	-0.0017	0.0079	-0.0166	0.0127	-0 0033	-0 0015	0.0071	0 0079	0 095	
0	0	0	0	0	0	0	0	0	0	0	0	0	0	

x/c	159
-0.5	-∞
-0.4	-1 314
-0.3	-1 126
-0.2	-1.064
-0.1	-0 976
0.0	-0.862
0.1	-0.760
0.2	-0.600
0.3	-0.388
0.4	-0 190
0.5	0

SUB-PROCEDURE 6

COMPUTATION OF OUTER AND INNER SHROUD SURFACE PRESSURE COEFFICIENTS

(1) Write the first seven elements of COLUMN 61 on WORKSHEET I as the first element of COLUMNS 161, 163, 165, 167, 169, 171 and 173 respectively.

160	161	162	163	164	165	166	167	168	169	170	171	172	173	174	175	176	177	178
1 4971	0.129	0 7496	0 297	0	0 109	-0.0009	-0 003	0	0 029	-0 0001	0 022	0	0 012	0 0212	0 1459	0	-0 1996	-0.0096
-0.7777		0		-0.3919		0		0.0031		0		0.0000		0.0685		0.0540		0
0.0040		0.1959		0		-0.1950		0		0.0010		0		0.0239		0		-0.0113
0.0061		0		0.1300		0		-0.1273		0		0.0004		-0.0002		-0.0043		0
0.0005		-0 0003		0		0.0955		0		-0.0947		0		0.0000		0		-0.0002
0.0000		0		-0.0004		0		0.0757		0		-0.0755		-0.0002		-0.0002		0
0.0000		0.0000		0		-0.0002		0		0 0629		0		0 0000		0		-0.0001

(3) 188 = 160 × 161
189 = 162 × 163
190 = 164 × 165
191 = 166 × 167
192 = 168 × 169
193 = 170 × 171
194 = 172 × 173

188	189	190	191	192	193	194	195	196	197	198	199	200	201	202	203	204
0.1931	0.2226	0	0.0000	0	0 0000	0	0 0031	0	0 0038	0	0 0015	0	-0.0026	0.422	-1	-0 422
-0.1003	0	-0.0427	0	0.0001	0	0.0000	0 0100	-0 0108	0	-0 0029	0	0 0011	0	-0.146		0 146
0.0005	0.0582	0	0.0006	0	0.0000	0	0 0035	0	0.0045	0	0.0018	0	-0 0030	0.066		-0.066
0.0008	0	0 0142	0	-0.0037	0	0.0000	0.0000	0.0009	0	-0 0007	0	0.0007	0	0 012		-0.012
0 0001	-0.0002	0	-0.0003	0	-0.0021	0	0 0000	0	0.0001	0	0.0000	0	-0 0002	-0 003		0.003
0.0000	0	0.0000	0	0.0022	0	-0.0009	0.0000	0 0000	0	0.0002	0	0.0000	0	0.002		-0.002
0.0000	0.0000	0	0.0000	0	0.0014	0	0.0000	0	0.0000	0	0.0000	0	0.0000	0.001		-0.001

(6) Write the elements of COLUMN 204 as the first element of COLUMNS 206, 208, 210, 212, 214, 216 and 218 respectively.

205	206	207	208	209	210	211	212	213	214	215	216	217
0.5000	-0.422	-0.5000	0.146	-0.5000	-0.066	-0.5000	-0.012	-0.5000	0.003	-0.5000	-0.002	-0.5000
0.5000		-0.4000		-0.1400		0.1760		0.3816		0.4986		0.3761
0.5000		-0.3000		0.1400		0.4680		0.4216		0.0379		-0.3761
0.5000		-0.2000		0.3400		0.4720		0.0376		-0.4419		-0.3911
0.5000		-0.1000		0.4600		0.2840		-0.3464		-0.4226		0.1774
0.5000		0		0.5000		0		-0.5000		0		0.5000
0.5000		0.1000		0.4600		-0.2840		-0.3464		0.4226		0.1774
0.5000		0.2000		0.3400		-0.4720		0.0376		0.4419		-0.3911
0.5000		0.3000		0.1400		-0.4680		0.4216		-0.0379		-0.3761
0.5000		0.4000		-0.1400		-0.1760		0.3816		-0.4986		0.3761
0.5000		0.5000		-0.5000		0.5000		-0.5000		0.5000		-0.5000

(8) 230 = 228 ÷ 229

Write the element of COLUMN 230 as the second element of COLUMN 232

For NACA 4 or 5 digit airfoil sections, write the value 1 000 in the last element of COLUMN 232

OR

For NACA 6-digit airfoil sections, write the element of COLUMN 230 as the last element of COLUMN 232

233 = 231 × 232
235 = 233 + 234
236 = 233 × 235
241 = 236 ÷ 234

226	227	228	229	230	231	232	233	234	235	236	237	238	239	240	241	242
-0 072	0.[illegible]00	0 1074	0.060	1 790	2.000	1.000	2.000	-4.000	-2.000	-4.000	-1	∞	-0 245	-0 014	1.000	-∞
-0.081					-0 104	1.790	-0.186		-4.186	0.779		0.657	-0.263	-0 016	-0 195	-0.657
-0.093					-0.124		-0.222		-1.222	0.937		0.563	-0 265	-0 019	-0 234	-0.563
-0.106					-0.134		-0.240		-1.240	1.018		0.532	-0.267	-0.021	-0.255	-0.532
-0.122					-0.140		-0.251		-4.251	1.067		0.488	-0.260	-0.024	-0.267	-0.488
-0 139					-0.146		-0.261		-4.261	1.112		0.431	-0.246	-0.028	-0.278	-0.431
-0 149					-0.150		-0.269		-4.269	1.148		0.390	-0.225	-0.030	-0.287	-0.390
-0.110					-0.114		-0.204		-4.204	0.855		0.300	-0.199	-0.022	-0.215	-0.300
0.110					-0.040		-0.072		-4.072	0.293		0.194	-0.169	0.022	-0.073	-0.194
0.149					0.052		0.093		-3.907	-0.363		0.095	-0.140	0.030	0.091	-0.095
0.139					0.186	1.790	0.333		-3.667	-1.221		0	-0.113	0 028	0 305	0

x/c	243	244
-0.5	∞	-∞
-0.4	0.183	-1.131
-0.3	0 042	-1.084
-0.2	-0.011	-1.075
-0.1	-0.063	-1.039
0.0	-0 121	-0.983
0.1	-0.152	-0.932
0.2	-0.136	-0.738
0.3	-0.026	-0.114
0.4	0.076	-0.114
0.5	0.220	0.220

FIGURE 7

COMPLETED WORKSHEET II FOR INTERPOLATION/EXTRAPO

II

...ICIENTS

131	132	133	134	135	136	137	138	139	140	141	142	143
0.012	0	0.017	0	0.014	0	0.007	0	0.010	0	0.010	0	0.008
	-0.9785		-0.9066		-0.4721		0.1513		0.7141		0.9913	
	?.2064		0.9066		0.8816		0.1513		-0.7000		-0.9913	
	0.9661		0.1500		-0.8462		-0.8269		0.1847		0.9746	
	-0.1606		-0.9992		-0.2391		0.8959		0.6005		-0.6646	
	-1.0000		0		1.0000		0		-1.0000		0	
	-0.1606		0.9992		-0.2391		-0.8959		0.6005		0.6646	
	0.9661		-0.1500		-0.8462		0.8269		0.1847		-0.9746	
	0.2064		-0.9066		0.8816		-0.1313		-0.7000		0.9913	
	-0.9785		0.9066		-0.4721		-0.1513		0.7141		-0.9913	
	0		0		0		0		0		0	

x/c	159
-0.5	-∞
-0.4	-1.314
-0.3	-1.126
-0.2	-1.064
-0.1	-0.976
0.0	-0.862
0.1	-0.780
0.2	-0.600
0.3	-0.388
0.4	-0.190
0.5	0

+ ↑ ↓ −

(3) 151 = 132 × 133
152 = 134 × 135
153 = 136 × 137
154 = 138 × 139
155 = 140 × 141
156 = 142 × 143
157 = 144 + 145 + 146 + 147 + 148 + 149 + 150 + 151 + 152 + 153 + 154 + 155 + 156

Δc_p = 159 = 157 × 158

...URE COEFFICIENTS

177	178	179	180	181	182	183	184	185	186	187
-0.1996	-0.009?	3.3938	0	-0.5225	-0.0033	-0.4498	0	0.9412	-0.0013	2.0198
	0		0.0056		0		0.0012		0	
	-0.0115		0		-0.0040		0		-0.0015	
	0		0.0014		0		0.0007		0	
	-0.0002		0		0.0000		0		-0.0001	
	0		-0.0003		0		0.0000		0	
	-0.0001		0		0.0001		0		0.0000	

(2) Write the elements of COLUMN 5 on WORKSHEET I as the first element of COLUMNS 175, 177, 179, 181, 183, 185 and 187 respectively

...4
...33
...46
...66
...12
...03
...02
...01

(4) 195 = 174 × 175
196 = 176 × 177
197 = 178 × 179
198 = 180 × 181
199 = 182 × 183
200 = 184 × 185
201 = 186 × 187

(5) 202 = 188 + 189 + 190 + 191 + 192 + 193 + 194 + 195 + 196 + 197 + 198 + 199 + 200 + 201
204 = 202 × 203

216	217	218
-0.002	-0.5000	-0.001
	0.3761	
	-0.3761	
	-0.3911	
	0.1774	
	0.5000	
	0.1774	
	-0.3911	
	-0.3761	
	0.3761	
	-0.5000	

219	220	221	222	223	224	225
-0.2110	-0.0730	0.0330	0.0060	-0.0015	0.0010	0.0005
-0.2110	-0.0554	0.0092	-0.0021	0.0011	-0.0010	-0.0004
-0.2110	-0.0438	-0.0092	-0.0056	0.0013	-0.0001	0.0004
-0.2110	-0.0292	-0.0224	-0.0057	0.0001	0.0009	0.0004
-0.2110	-0.0146	-0.0304	-0.0034	-0.0010	0.0008	-0.0002
-0.2110	0	-0.0330	0	-0.0015	0	-0.0005
-0.2110	0.0146	-0.0304	0.0034	-0.0010	-0.0008	-0.0002
-0.2110	0.0292	-0.0224	0.0057	0.0001	-0.0009	0.0004
-0.2110	0.0435	-0.0092	0.0056	0.0013	0.0001	0.0004
-0.2110	0.0554	0.0092	0.0021	0.0011	0.0010	-0.0004
-0.2110	0.0730	0.0330	-0.0060	-0.0015	-0.0010	0.0005

(7) 219 = 205 × 206
220 = 207 × 208
221 = 209 × 210
222 = 211 × 212
223 = 213 × 214
224 = 215 × 216
225 = 217 × 218

x/c	243	244
-0.5	∞	-∞
-0.4	0.183	-1.131
-0.3	0.042	-1.084
-0.2	-0.011	-1.075
-0.1	-0.063	-1.039
0.0	-0.121	-0.983
0.1	-0.152	-0.932
0.2	-0.136	-0.736
0.3	-0.026	-0.414
0.4	0.076	-0.114
0.5	0.220	0.220

+ ↑ ↓ −

(9) Write the elements of COLUMN 157 as the corresponding elements of COLUMN 238

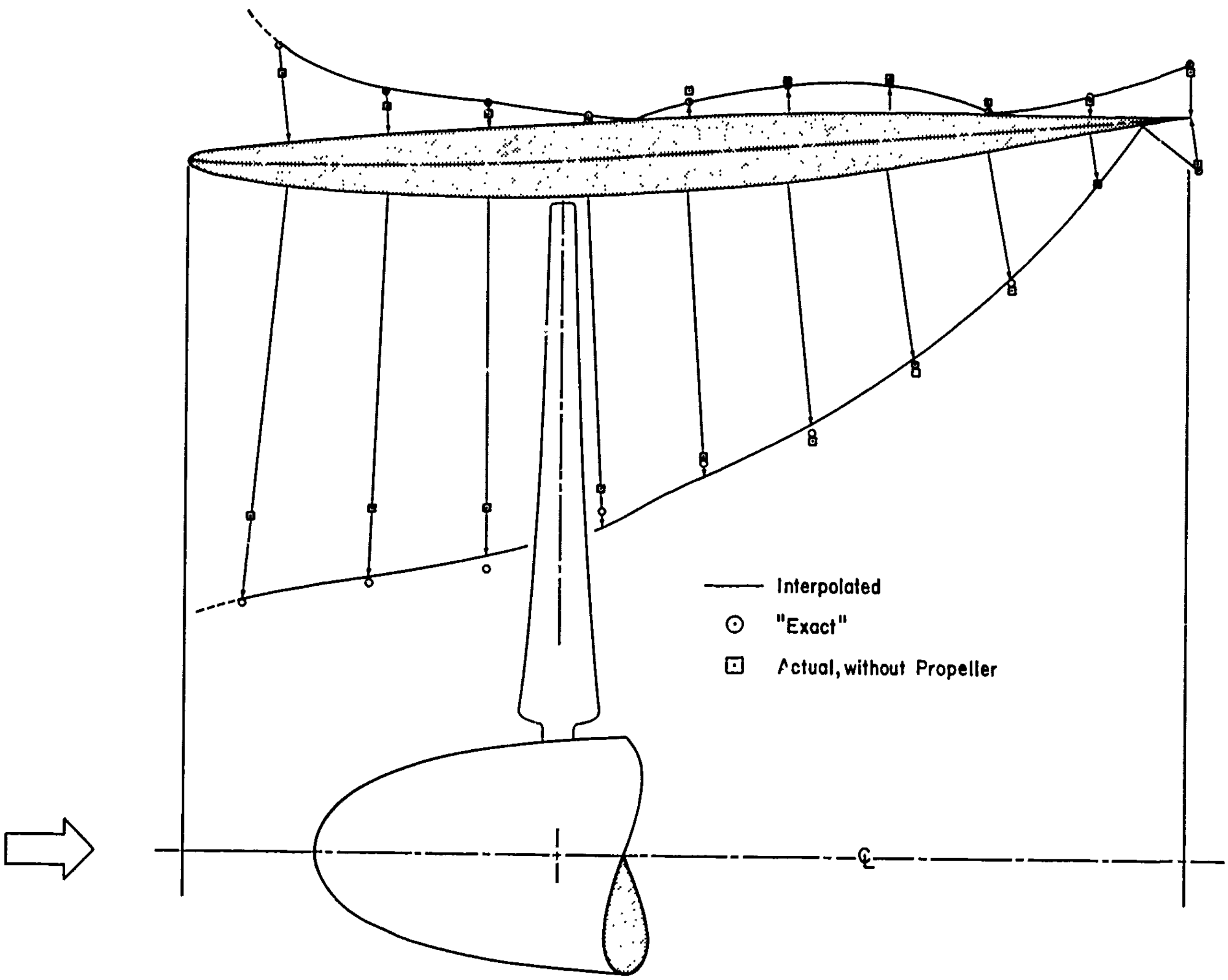
239 = 219 + 220 + 221 + 222 + 223 + 224 + 225
240 = 226 × 227
242 = 237 × 238

c_p (OUTER) = 243 = 238 + 239 + 240 + 241
c_p (INNER) = 244 = 231 + 240 + 241 + 242
} QUADRATIC

c_p (OUTER) = 243 = 233 + 238 + 239 + 240
c_p (INNER) = 244 = 232 + 239 + 240 + 242
} LINEAR

...XTRAPOLATION EXAMPLE, $x = 0.25$

2



x/c
-0.50
-0.40
-0.30
-0.20
-0.10
0
0.10
0.20
0.30
0.40
0.50

x/c
-0.50
-0.40
-0.30
-0.20
-0.10
0
0.10
0.20
0.30
0.40
0.50

FIGURE 8

A COMPARISON OF INTERPOLATED
AND
"EXACT" SHROUD SURFACE PRESSURE DISTRIBUTIONS

SHROUD OUTER SURFACE PRESSURE DISTRIBUTION

				Interpolated	"Exact"
x/c	χ=-0.25	χ=0.0	χ=0.25	χ=-0.125	χ=-0.125
-0.50	∞	∞	∞	∞	∞
-0.40	0.231	0.242	0.183	0.245	0.241
-0.30	0.093	0.113	0.042	0.114	0.107
-0.20	0.049	0.065	-0.011	0.069	0.063
-0.10	-0.008	0.016	-0.063	0.017	0.017
0	-0.056	-0.036	-0.121	-0.033	-0.039
0.10	-0.088	-0.068	-0.152	-0.065	-0.068
0.20	-0.083	-0.067	-0.136	-0.064	-0.071
0.30	-0.011	-0.008	-0.026	-0.007	-0.008
0.40	0.053	0.048	0.076	0.046	0.046
0.50	0.154	0.130	0.220	0.128	0.132

SHROUD INNER SURFACE PRESSURE DISTRIBUTION

				Interpolated	"Exact"
x/c	χ=-0.25	χ=0.0	χ=0.25	χ=-0.125	χ=-0.125
-0.50	-∞	-∞	-∞	-∞	-∞
-0.40	-1.051	-1.024	-1.131	-1.021	1.029
-0.30	-0.955	-0.955	-1.084	-0.939	-0.955
-0.20	-0.837	-0.931	-1.075	-0.878	-0.913
-0.10	-0.760	-0.876	-1.039	-0.812	-0.781
0	-0.704	-0.746	-0.983	-0.701	-0.673
0.10	-0.652	-0.624	-0.932	-0.596	-0.618
0.20	-0.515	-0.485	-0.736	-0.465	-0.485
0.30	-0.339	-0.322	-0.414	-0.317	-0.326
0.40	-0.119	-0.122	-0.114	-0.122	-0.120
0.50	0.154	0.130	0.220	0.128	0.132

the tabulation of the three sets of interpolation data. The extent of the interpolation involved is reflected by comparison with the results included for the case with no propeller present. Again, we find that the overall agreement is very good and clearly seems to justify such interpolation or extrapolation.

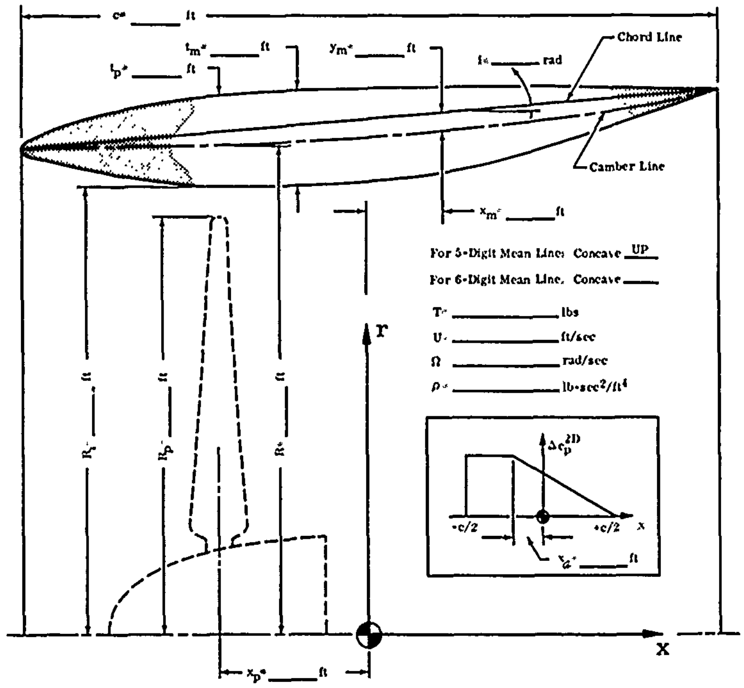
2.4 Example for Parametric Studies

The third and final example illustrates the use of the evaluation procedure as a vehicle for parametric studies. We have chosen to find the variation of the shroud thrust coefficient with the shroud incidence holding the remaining parameters fixed.

For this calculation, it is not necessary to consider a specific configuration nor SUB-PROCEDURES 3, 5 and 6 . The worksheets appropriately completed for $i = -0.20$, 0.0 , and 0.20 rad are shown altogether in Fig. 9 . Only those columns having more than one value in any element have to be changed in performing the calculation for each value of i . The uppermost value corresponds to $i = -0.20$ rad ; the lower-left value corresponds to $i = 0.0$ rad ; and the lower-right value corresponds to $i = 0.20$ rad .

The results of the evaluation are plotted in Fig. 10 and show that the variation is exactly linear over the range examined. This result is not unexpected. That is, the shroud thrust coefficient is determined

SUB-PROCEDURE 1
DETERMINATION OF PARAMETERS



GROSS GEOMETRIC AND FLIGHT PARAMETERS

PARAMETER	ACTUAL	EVALUATED
$C_T = T/\frac{1}{2}\rho U^2 \pi R_p^2$		0.250
N		6
$\epsilon = R_p/R_i$		0.994
$\chi = x_p/c$		-0.25
$\mu = R_p/R$		0.970
$\lambda = c/2R$		0.25
$J = U/\Omega R_p$		0.25

THICKNESS PARAMETERS

PARAMETER	ACTUAL	EVALUATED
NACA AIRFOIL SECTION		5-DIGIT
t_m/c		0.0976

GEOMETRIC CAMBER PARAMETERS

PARAMETER	ACTUAL	EVALUATED
NACA MEAN LINE		5-DIGIT [illegible]
$p = x_m/c$		
$m = y_m/c$		
$a = x_a/c$		
c_{l_i}		
2i		[illegible]

COMPUTAT

① 4 = 2 + 3
5 = 1 × 4

ν	1	2	3
0	1.0472	0.0976	1
1	-3.1513		
2	-3.0960		
3	9.7560		
4	-32.4800		
5	0		
6	0		

6	7	8	9	10	11	12	13
0.7064	0.1022	0.2499	-0.3076	0	-0.3022	0.0052	[illegible]
-0.1527		0		0.0135		0	
0.0167		0.0272		0		-0.0003	
-0.0041		0		-0.0027		0	
0.0018		0.0026		0		0.0003	
-0.0009		0		-0.0004		0	
0.0005		0.0008		0		0.0001	

④ 29 = 27 × 28
33 = 31 × 32
36 = 29 + 30
37 = 33 × 35
38 = 34 × 35
39 = 36 - 37 + 38

ν	27	28	29	30	31	32
0	0.044	-1	-0.044	[illegible]	-0.319	0.250
1	-0.191		0.191	0	0.127	
2	-0.129		0.129		-0.055	
3	-0.061		0.061		-0.059	
4	-0.013		0.013		-0.016	
5	0.005		-0.005		0.013	
6	0.005		-0.005		0.016	
7	0.000		0.000		0.005	
8	-0.002		0.002		-0.005	
9	0.000		0.000		-0.006	
10	0.001		-0.001		-0.002	
11	0.001		-0.001		0.002	
12	0.000		0.000		0.003	

40	41	42	43	44	45	46	47
1.0277	[illegible]	0	0.180	0.0139	0.149	0	0.076
0.0568		1.0308		0.0008		-0.0031	
0.0063		0		1.0041		0	
-0.0001		-0.0010		0.0000		1.0015	
0.0000		0		-0.0005		0	
0.0000		0.0000		0.0000		-0.0003	
0.0000		0		0.0000		0	

SUB-PROCEDURE 3
COMPUTATION OF SHROUD SECTIONAL RADIAL FORCE AND MOMENT COEFFICIENTS AND CENTER OF PRESSURE

① Write the first three elements of COLUMN 61 as the element of COLUMNS 62, 63 and 64 respectively.

62	63	64

② 66 = 62 × 65
68 = 63 × 67

c_z = 69 = 66 + 68

-π —

65	66
-3.1416	

-π/2 —

67	68	69
-1.5708		

+↑ ↓−

③ 71 = 62 × 70
73 = 64 × 72

c_m = 74 = 71 + 73

-π/8 —

70	71
-0.3927	

π/8 —

72	73	74
0.3927		

(+ −)

④ 75 = 74 ÷ 69

x_{cp}/c = 77 = 75 + 76

75	76	77
	-0.250	

① Write the elements of COLUMN 5 as the elements of COLUMN 79.

② Write the elements of COLUMN 33, corresponding to ν = 1,2,3 ... 11, as the corresponding elements of COLUMN 83.

③ Write the elements of COLUMN 33, corresponding to ν = 2,3,4 ... 12, as the corresponding elements of COLUMN 86.

④ Write the first element of COLUMN 33, corresponding to ν = 0, as the element of COLUMN 89.

⑤ Write the second element of COLUMN 33, corresponding to ν = 1, as the element of COLUMN 90.

⑥ Write the elements of COLUMN 61, corresponding to ν = 2,3,4 ... 12, as the corresponding elements of COLUMN 84.

⑦ Write the elements of COLUMN 61, corresponding to ν = 1,2,3 ... 11, as the corresponding elements of COLUMN 87.

⑧ Write the first element of COLUMN 61, corresponding to ν = 0, as the element of COLUMN 91.

⑨ Write the second element of COLUMN 61, corresponding to ν = 1, as the element of COLUMN 92.

⑩ 80 = 78 × 79
82 = 80 × 81
85 = 83 × 84
88 = 86 × 87

⑪ 94 = 89 × 91
96 = 89 × 92
98 = 90 × 92
100 = Algebraic sum of 85

89	90
-0.080	[illegible]

93	94
4.000	[illegible]

π/8 —

101	102
0.3927	[illegible]

110	111
-4.000	[illegible]

FIGURE 9

COMPLETED WORKSHEET I FOR PARAMET

I

SUB-PROCEDURE 2

COMPUTATION OF THREE-DIMENSIONAL GLAUERT COEFFICIENTS OF EFFECTIVE CAMBER

ν	1	2	3	4	5
0	1.0472	0.0976	1	0.0976	0.1022
1	-3.1513				-0.3076
2	-3.0960				-0.3022
3	9.7560				0.9522
4	-32.4800				-3.1700
5	0				0
6	0				0

(2) Write the elements of column 5 as the first element of columns 7, 9, 11, 13, 15, 17 and 19 respectively.

(3) 20 = 6 × 7
21 = 8 × 9
22 = 10 × 11
23 = 12 × 13
24 = 14 × 15
25 = 16 × 17
26 = 18 × 19
34 = 20 + 21 + 22 + 23 + 24 + 25 + 26

10	11	12	13	14	15	16	17	18	19
0	-0.3022	0.0052	0.9522	0	-3.1700	0.0002	0	0	0
0.0135		0		0.0005		0		0.0000	
0		-0.0003		0		0.0000		0	
-0.0027		0		0.0000		0		0.0000	
0		0.0003		0		0.0000		0	
-0.0004		0		0.0060		0		0.0000	
0		0.0001		0		0.0000		0	

20	21	22	23	24	25	26
0.0722	-0.0769	0	0.0050	0	0	0
-0.0156	0	-0.0041	0	-0.0016	0	0
0.0017	-0.0484	0	-0.0003	0	0	0
-0.0004	0	0.0008	0	0.0000	0	0
0.0002	-0.0008	0	0.0003	0	0	0
-0.0001	0	0.0001	0	0.0000	0	0
0.0001	-0.0002	0	0.0001	0	0	0

29	30	31	32	33	34	35	36	37	38	39	ν
-0.044	[illegible]	-0.319	0.250	-0.080	0.000	-1	[illegible]	0.050	0.000	[illegible]	0
0.191	0	0.127		0.032	-0.021		0.191	-0.032	0.021	0.180	1
0.129		-0.055		-0.014	-0.006		0.129	0.014	0.006	0.149	2
0.061		-0.059		-0.015	0.000		0.061	0.015	0.000	0.076	3
0.013		-0.016		-0.004	0.000		0.013	0.004	0.000	0.017	4
-0.005		0.013		0.003	0.000		-0.005	-0.003	0.000	-0.008	5
-0.005		0.016		0.004	0.000		-0.005	-0.004	0.000	-0.009	6
0.000		0.005		0.001	0		0.000	-0.001	0	-0.001	7
0.002		-0.005		-0.001			0.002	0.001	0	0.003	8
0.000		-0.006		-0.002			0.000	0.002	0	0.002	9
-0.001		-0.002		-0.001			-0.001	0.001	0	0.000	10
-0.001		0.002		0.001			-0.001	-0.001	0	-0.002	11
0.000		0.003		0.001			0.000	-0.001	0	-0.001	12

(5) Write the first seven elements of column 39 as the first element of columns 41, 43, 45, 47, 49, 51 and 53 respectively.

(6) 54 = 40 × 41
55 = 42 × 43
56 = 44 × 45
57 = 46 × 47
58 = 48 × 49
59 = 50 × 51
60 = 52 × 53

44	45	46	47	48	49	50	51	52	53
0.0139	0.149	0	0.076	0.0000	0.017	0	-0.008	0.0000	-0.009
0.0008		-0.0031		0.0000		0.0000		0.0000	
1.0041		0		-0.0010		0		0.0000	
0.0000		1.0015		0.0000		-0.0005		0.0000	
-0.0005		0		1.0008		0		-0.0003	
0.0000		-0.0003		0.0000		1.0005		0.0000	
0.0000		0		-0.0002		0		1.0003	

54	55	56	57	58	59	60
[illegible]	0	0.0021	0	0.0000	0	0.0000
[illegible]	0.1855	0.0001	-0.0002	0.0000	0.0000	0.0000
[illegible]	0	0.1496	0	0.0000	0	0.0000
0.0000	-0.0002	0.0000	0.0761	0.0000	0.0000	0.0000
0.0000	0	-0.0001	0	0.0170	0	0.0000
0.0000	0.0000	0.0000	0.00000	0.0000	-0.0050	0.0000
0.0060	0	0.0000	0	0.0000	0	-0.0090

ν	61
0	[illegible]
1	[illegible]
2	[illegible]
3	0.076
4	0.017
5	-0.008
6	-0.009
7	-0.001
8	0.003
9	0.002
10	0.000
11	-0.002
12	-0.001

(7) $c_\nu^{3D} = 61 = 54 + 55 + 56 + 57 + 58 + 59 + 60$, $\nu = 0, 1, 2 \ldots 6$

$c_\nu^{3D} = 61 = 39$, $\nu = 7, 8, 9 \ldots 12$

SUB-PROCEDURE 4

COMPUTATION OF SHROUD THRUST COEFFICIENT

... 5 as the elements of column 79.

(7) Write the elements of column 61, corresponding to ν=1,2,3 ... 11, as the corresponding elements of column 87.

(8) Write the first element of column 61, corresponding to ν=0, as the element of column 91.

(9) Write the second element of column 61, corresponding to ν=1, as the element of column 92.

ν	78	79	80	81	82
0	0.008	0.1022	0.0008	0.250	0.000
1	0.051	-0.3076	-0.0249		-0.006
2	0.014	-0.3022	-0.0042		-0.001
3	0.000	0.9522	0.0000		0.000
4	0.001	-3.1700	-0.0032		-0.001
5	0.000	0	0		0
6	0.000	0	0		0

ν	83
1	0.032
2	-0.014
3	-0.015
4	-0.004
5	0.003
6	0.004
7	0.001
8	-0.001
9	-0.002
10	-0.001
11	0.001

ν	84	85
2	[illegible]	[illegible]
3	0.076	-0.001
4	0.017	0.000
5	-0.008	0.000
6	-0.009	0.000
7	-0.001	0.000
8	0.003	0.000
9	0.002	0.000
10	0.000	0.000
11	-0.002	0.000
12	-0.001	0.000

ν	86
2	-0.014
3	-0.015
4	-0.004
5	0.003
6	0.004
7	0.001
8	-0.001
9	-0.002
10	-0.001
11	0.001
12	0.001

ν	87	88
1	[illegible]	[illegible]
2	[illegible]	[illegible]
3	0.076	0.000
4	0.017	0.000
5	-0.008	0.000
6	-0.009	0.000
7	-0.001	0.000
8	0.003	0.000
9	0.002	0.000
10	0.000	0.000
11	-0.002	0.000

89	90	91	92
-0.080	0.032	[illegible]	[illegible]

93	94	95	96	97	98	99	100
4.000	[illegible]	2.000	[illegible]	-2.000	[illegible]	-1	[illegible]

π/8 —

101	102	103	104	105	106	107	108	109
0.3927	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	-0.008

110	111	112	113	114	115	116	117
-4.600	0.970	0.25	-4.1237	0.2577	-1.0627	[illegible]	[illegible]

...× 91
...× 92
...× 92 -
...braic sum of 85

(12) 102 = Algebraic sum of 88
103 = 93 × 91
104 = 95 × 96
105 = 97 × 98
106 = 99 × 100
107 = 102 - 103 - 104 - 105 - 106
108 = 101 × 107
109 = Algebraic sum of 82

(13) 113 = 110 + 111
114 = 112 + 111
115 = 113 × 114
116 = 108 - 109

C_ℓ = 117 = 115 × 116

FIGURE 9

... FOR PARAMETRIC STUDY EXAMPLE

2

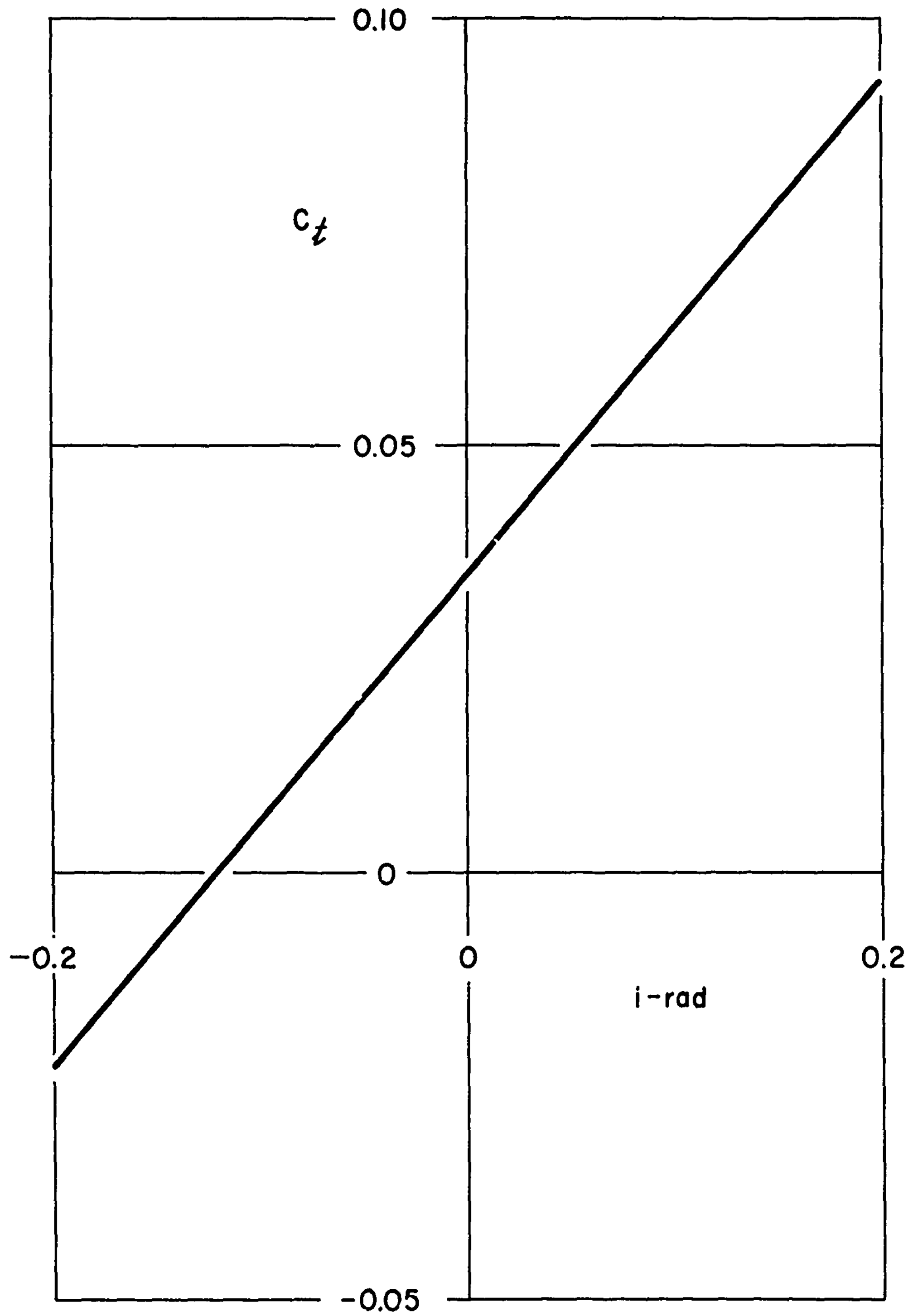


FIGURE 10

VARIATION OF SHROUD THRUST COEFFICIENT C_t WITH SHROUD INCIDENCE i
OTHER PARAMETERS FIXED

by the product of the three-dimensional Glauert coefficients of the effective camber and the two-dimensional Glauert coefficients of the propeller induced camber. With all parameters fixed, except i , the three-dimensional Glauert coefficients of the effective camber are independent of shroud incidence. Therefore, the shroud thrust coefficient will also be proportional to the shroud incidence.

The crossover point on Fig. 10 where $C_{\ell} = 0.0$ determines the value of shroud incidence at which the shroud has no effect on the inflow to the propeller. For angles to the right of this point the shroud will increase the inflow and for angles to the left of this point it will decrease the inflow to the propeller.

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SUB-PROCEDURE 1

DETERMINATION OF PARAMETERS

(Use WORKSHEET I)

1. For the configuration to be evaluated, enter N, the NACA airfoil section designation, and the NACA mean line designation in the appropriate locations below the figure on WORKSHEET I. Also fill in all the dimensions c, R, ..., indicated on the figure itself with these exceptions:

   i. x_m and y_m are applicable only when an NACA 4-digit mean line is being used.

   ii. x_a and the inset in the figure on WORKSHEET I are applicable only when an NACA 6-digit mean line is being used.

   The following sign conventions must be observed:

   i. x_p, x_m and x_a are positive or negative depending on their location relative to the chosen coordinate system, i.e., positive to the right of the midchord and negative to the left.

   ii. y_m is measured relative to the chord line, and is positive when above and negative when below this reference.

   iii. All other dimensions are positive.

iv. i is positive in a counter-clockwise sense.

Record the physical flight conditions T , U , Ω and ρ .

2. Compute the remaining parameters from the equations which are given and the data from STEP 1. Write the results in the columns headed ACTUAL. The following exceptions should be noted:

   i. p and m are applicable only when an NACA 4-digit mean line is being used.

   ii. a and c_{ℓ_i} are applicable only when an NACA 6-digit line is being used. c_{ℓ_i} is presumably known and is simply written down; it is positive if the mean line is concave downward (⌒) and negative, if concave upward (◡) .

3. Use the TABLE OF PARAMETERS and choose where necessary the values of the tabulated parameters which are closest to (larger or smaller) or equal to the actual values; write these values in the indicated locations under the column headed EVALUATED. For the parameters which can have arbitrary values, use the actual values in the evaluation except for t_m/c. The value to use for t_m/c is described in the next step.

4. For finite thickness, compute the consistent value of t_m/c to be used in the evaluation as follows:

i. Use the value of e , μ and λ from the column headed EVALUATED , and find the corresponding shroud thickness ratio at the propeller plane t_p/c from TABLE 2.1 .

ii. Multiply the value of x in the column headed EVALUATED by the value of c and obtain a "new" value of x_p .

iii. Using the actual configuration determine the "new" value of t_p corresponding to the "new" value of x_p .

iv. Take t_m from the figure on WORKSHEET I and with the "new" value of t_p form the ratio t_m/t_p and multiply it by the value of t_p/c from TABLE 2.1 . Enter the result in the location t_m/c in the column headed EVALUATED .

For zero thickness, use the value 0 in the evaluation.

5. In the remaining sub-procedures, the values of all parameters required will be taken from the column headed EVALUATED.

SUB-PROCEDURE 2

COMPUTATION OF THREE-DIMENSIONAL GLAUERT COEFFICIENTS OF EFFECTIVE CAMBER

(Use WORKSHEET I)

1. Write the value of t_m/c in COLUMN 2 .
2. Write the value of C_T in COLUMN 32 .
3. Write the appropriate GEOMETRIC CAMBER PARAMETERS in the indicated columns as follows:
   - i. For an NACA 4-digit mean line write the value of m in COLUMN 28 and the value 2i in COLUMN 30 .
   - ii. For an NACA 5-digit mean line write the value 1 in COLUMN 28 if the mean line is concave downward, or the value -1 if the mean line is concave upward; also write the value 2i in COLUMN 30 .
   - iii. For an NACA 6-digit mean line, write the value c_{ℓ_i} in COLUMN 28 and the value 2i in COLUMN 30 .
4. Use the value of λ and the THICKNESS PARAMETERS to pick the coefficients of the shroud source strength distribution a_ν from TABLES 3.1 - 3.2 and proceed as follows:
   - i. For an NACA 4- or 5-digit airfoil, write the appropriate column of numbers from TABLE 3.1 in COLUMN 1 and the value 1 in COLUMN 3 .

ii. For an NACA 6-digit airfoil, choose the column headings in TABLE 3.2 corresponding to the 6-digit family with the <u>same or closest smaller</u> value of t_m/c and write this column of numbers in COLUMN 1; if the table does not contain a smaller value of t_m/c, use the column with the smallest value of t_m/c available. Also write the value of t_m/c from the column heading used in COLUMN 3.

iii. For zero thickness, write the value 0 in all the elements of COLUMN 34.

5. Use the value of λ to pick the elements for the evaluation of the camber induced by shroud thickness $Q_{k,\ell}$ from TABLES 4.1 - 4.3. Write each column of numbers from the appropriate table in COLUMNS 6, 8, 10, 12, 14, 16 and 18 respectively. For zero thickness, omit this step.

6. Use the GEOMETRIC CAMBER PARAMETERS to pick the two-dimensional Glauert coefficients of the geometric camber ϵ_ν from TABLES 5.1 - 5.3. Write the column of numbers from the appropriate table in COLUMN 27. For NACA 4-digit mean lines, with $p = 0.40$, 0.30, 0.25, 0.20, or 0.10 use the data for the corresponding negative value of p with the sign of the numbers for $\nu = 0, 2, 4, 6, 8, 10$ and 12 reversed.

7. Use the values of the GROSS GEOMETRIC AND FLIGHT PARAMETERS to pick the two-dimensional Glauert coefficients of the propeller induced camber $\epsilon_{\Gamma',\nu}$ from TABLES 6.1 - 6.18 . Write the column of numbers from the appropriate table in COLUMN 31 . For $\chi = 0.25$, use the tables for $\chi = -0.25$ with the sign of the numbers corresponding to $\nu = 1, 3, 5, 7, 9$ and 11 reversed.

8. Use the value of λ to pick the elements for the curvature correction of the two-dimensional Glauert coefficients of the effective shroud camber $O_{k,\ell}$ from TABLES 7.1 - 7.3 . Write each column of numbers from the appropriate table in COLUMNS 40, 42, 44, 46, 48, 50 and 52 respectively.

9. Compute the three-dimensional Glauert coefficients of the effective camber c_{ν}^{3D} by following the instructions given in SUB-PROCEDURE 2 on WORKSHEET I; for zero thickness, omit the instructions in STEPS 1, 2 and 3 .

SUB-PROCEDURE 3

COMPUTATION OF SHROUD SECTIONAL RADIAL FORCE AND MOMENT COEFFICIENTS AND CENTER OF PRESSURE

(Use WORKSHEET I)

1. Compute the shroud sectional radial force coefficient c_r, the pitching moment coefficient c_m, and the non-dimensional center of pressure x_{cp}/c by following the instructions given in SUB-PROCEDURE 3 on WORKSHEET I .

SUB-PROCEDURE 4

COMPUTATION OF SHROUD THRUST COEFFICIENT

(Use WORKSHEET I)

1. Use the values of the GROSS GEOMETRIC AND FLIGHT PARAMETERS to pick the terms of the propeller-shroud thickness contribution to the shroud thrust coefficient $C_{\Gamma' t_{\nu}}$ from TABLES 8.1 - 8.27. Write the column of numbers from the appropriate table in COLUMN 78 . For zero thickness, omit this step and write the value 0 in all the elements of COLUMN 82 .
2. Write the value of C_T in COLUMN 81, the value of μ in COLUMN 111, and the value of λ in COLUMN 112 .
3. Compute the shroud thrust coefficient C_{t} by following the instructions given in SUB-PROCEDURE 4 on WORKSHEET II ; for zero thickness, omit the instructions in STEP 1 .

SUB-PROCEDURE 5

COMPUTATION OF NET SHROUD PRESSURE COEFFICIENT

(Use WORKSHEET II)

1. Compute the net shroud pressure coefficient $\Delta c_p(x/c)$ by following the instructions given in SUB-PROCEDURE 5 on WORKSHEET II.

SUB-PROCEDURE 6

COMPUTATION OF OUTER AND INNER SHROUD SURFACE PRESSURE COEFFICIENTS

(Use WORKSHEET II)

1. Write the value of C_T in COLUMN 227 .
2. Write the value of t_m/c in COLUMN 228 .
3. Use the value of λ to pick the elements for the shroud curvature contribution to the shroud surface pressure arising from the effective shroud camber $S_{k,\ell}$ from TABLES 9.1 - 9.3 . Write each column of numbers from the appropriate table in COLUMNS 160, 162, 164, 166, 168, 170 and 172 respectively.
4. Use the value of λ to pick the elements for the shroud curvature contribution to the shroud surface pressure arising from the shroud thickness $T_{k,\ell}$ from TABLES 10.1 - 10.3 . Write each column of numbers from the appropriate table in COLUMNS 174, 176, 178, 180, 182, 184 and 186 respectively. For zero thickness, omit this step.
5. Use the values of the GROSS GEOMETRIC AND FLIGHT PARAMETERS to pick the direct propeller contribution to the shroud surface pressure coefficients $c_{\Gamma}{}'(x/c)$ from TABLES 11.1 - 11.18 . Write the column of numbers from the appropriate table in COLUMN 226.

For $\chi = 0.25$, use the tables for $\chi = -0.25$ but invert each column and reverse the sign of each number.

6. Use the values of the THICKNESS PARAMETERS to pick the linearized, two-dimensional contribution of shroud thickness to the shroud surface pressure coefficient $c_f^{2D}(x/c)$ from TABLES 12.1 - 12.2 as follows:

   i. For an NACA 4- or 5-digit airfoil, choose the column heading in TABLE 12.1 having the same or closest smaller value of t_m/c and write this column of numbers in COLUMN 231 . Also write the value of t_m/c from the column heading used in COLUMN 229 .

   ii. For an NACA 6-digit airfoil, choose the column headings in TABLE 12.2 corresponding to the 6-digit family with the same or closest smaller value of t_m/c and write this column of numbers in COLUMN 231 ; if the tables do not contain a smaller value of t_m/c , use the column with the smallest value of t_m/c available. Also write the value of t_m/c from the column heading used in COLUMN 229 .

   iii. For zero thickness, write the value 0 in all the elements of COLUMNS 195, 196, 197, 198, 199, 200 and 201.

7. Compute the net shroud surface pressure coefficient by using SUB-PROCEDURE 5 .

8. Compute the shroud outer and inner surface pressure coefficients c_p(OUTER) and c_p(INNER) respectively by following the instructions given in SUB-PROCEDURE 6 on WORKSHEET II ; for zero thickness, omit the instructions in STEPS 2, 4 and 8. In this sub-procedure the quadratic form of the two-dimensional thickness contribution to the shroud surface pressure is used. If it is desired to use the linearized form, then follow the last instruction of STEP 9 .

TABLE OF PARAMETERS

GROSS GEOMETRIC AND FLIGHT PARAMETERS

PARAMETER	VALUES
C_T	Arbitrary
N	3, 4, 6
e	0.990, 0.992, 0.994
χ	-0.25, 0.0, 0.25
μ	0.900, 0.940, 0.970
λ	0.25, 0.50, 0.75
J	0.25, 0.50, 0.75

AIRFOIL THICKNESS PARAMETERS

t_m/c	See SUB-PROCEDURE 1, STEP 4.	NACA 4- AND 5-DIGIT AIRFOIL SECTIONS
FAMILY DESIGNATION	63, 64, 65, 66	NACA 6-DIGIT AIRFOIL SECTIONS
t_m/c	See SUB-PROCEDURE 1, STEP 4.	

AIRFOIL GEOMETRIC CAMBER PARAMETERS

p	∓0.40, ∓0.30, ∓0.25, ∓0.20, ∓0.10, 0.0	NACA 4-DIGIT MEAN LINES
m	Arbitrary	
DESIGNATION	210, 220, 230, 240, 250	NACA 5-DIGIT MEAN LINES
a	∓0.50, ∓0.40, ∓0.30, ∓0.20, ∓0.10, 0.0	NACA 6-DIGIT MEAN LINES
c_{l_i}	Arbitrary	
2i	Arbitrary	CHORD LINE INCIDENCE

TABLES 1.1 - 1.3

NON-DIMENSIONAL PROPELLER CIRCULATION DISTRIBUTION $\Gamma(\beta)/R_pU$ NORMALIZED SUCH THAT $C_T = 1$

$$\frac{\Gamma(\beta)}{R_p U} = A \frac{2\pi J}{N} \frac{\cos^2\beta}{J^2 + \cos^2\beta} \frac{F(\varphi, k)}{F(\pi/2, k)}$$

$$\cos\beta \equiv r/R_p \quad ; \quad \sin\varphi \equiv \left[\frac{k^2 - \operatorname{sech}^2 \frac{N\sqrt{J^2+1}}{2eJ}(1 - e\cos\beta)}{k^2 \tanh^2 \frac{N\sqrt{J^2+1}}{2eJ}(1 - e\cos\beta)}\right]^{\frac{1}{2}} \quad ; \quad k \equiv \operatorname{sech} \frac{N\sqrt{J^2+1}}{2eJ}(1-e)$$

$$A = \left[\frac{2N}{\pi J}\int_0^{\pi/2} \frac{\Gamma(\beta)}{AR_pU}\cos\beta \sin\beta \, d\beta\right]^{-1}$$

Accuracy: $\pm\ 0.0001$

$\Gamma(\beta)/R_pU$, TABLES 1.1 - 1.3

TABLE 1.1

NON-DIMENSIONAL PROPELLER CIRCULATION DISTRIBUTION $\Gamma(\beta)/R_pU$

		e=0.990			e=0.992			e=0.994		
$\beta°$	r/R_p	J=0.25	J=0.50	J=0.75	J=0.25	J=0.50	J=0.75	J=0.25	J=0.50	J=0.75
0	1.000	0	0	0	0	0	0	0	0	0
5	0.996	0.0725	0.1667	0.2843	0.0760	0.1750	0.2983	0.0809	0.1865	0.3178
10	0.985	0.1347	0.3087	0.5245	0.1394	0.3198	0.5433	0.1455	0.3344	0.5678
15	0.966	0.1844	0.4206	0.7102	0.1886	0.4308	0.7272	0.1939	0.4436	0.7485
20	0.940	0.2235	0.5066	0.8480	0.2267	0.5144	0.8609	0.2305	0.5240	0.8765
25	0.906	0.2541	0.5715	0.9456	0.2562	0.5767	0.9539	0.2586	0.5829	0.9636
30	0.866	0.2777	0.6185	1.0082	0.2788	0.6212	1.0122	0.2799	0.6244	1.0167
35	0.819	0.2951	0.6492	1.0386	0.2953	0.6497	1.0389	0.2954	0.6502	1.0390
40	0.766	0.3069	0.6640	1.0380	0.3064	0.6627	1.0354	0.3057	0.6610	1.0319
45	0.707	0.3132	0.6624	1.0066	0.3123	0.6598	1.0017	0.3109	0.6564	0.9957
50	0.643	0.3142	0.6434	0.9443	0.3129	0.6397	0.9380	0.3112	0.6352	0.9303
55	0.574	0.3096	0.6050	0.8515	0.3081	0.6008	0.8447	0.3061	0.5956	0.8362
60	0.500	0.2983	0.5455	0.7302	0.2967	0.5411	0.7235	0.2946	0.5358	0.7153
65	0.423	0.2784	0.4634	0.5853	0.2769	0.4593	0.5794	0.2748	0.4544	0.5722
70	0.342	0.2462	0.3598	0.4261	0.2448	0.3564	0.4215	0.2429	0.3523	0.4158
75	0.259	0.1961	0.2412	0.2675	0.1949	0.2389	0.2644	0.1933	0.2360	0.2607
80	0.174	0.1236	0.1239	0.1295	0.1228	0.1227	0.1280	0.1218	0.1212	0.1261
85	0.087	0.0412	0.0342	0.0343	0.0409	0.0338	0.0338	0.0406	0.0134	0.0333
90	0	0	0	0	0	0	0	0	0	0

N = 6

TABLE 1.3

NON-DIMENSIONAL PROPELLER CIRCULATION DISTRIBUTION $\Gamma(\beta)/R_pU$

		e=0.990			e=0.992			e=0.994		
$\beta°$	r/R_p	J=0.25	J=0.50	J=0.75	J=0.25	J=0.50	J=0.75	J=0.25	J=0.50	J=0.75
0	1.000	0	0	0	0	0	0	0	0	0
5	0.996	0.0403	0.0876	0.1464	0.0420	0.0917	0.1534	0.0443	0.0974	0.1631
10	0.985	0.0747	0.1621	0.2702	0.0768	0.1675	0.2793	0.0796	0.1745	0.2914
15	0.966	0.1018	0.2206	0.3655	0.1035	0.2253	0.3737	0.1057	0.2312	0.3838
20	0.940	0.1223	0.2650	0.4358	0.1234	0.2684	0.4417	0.1248	0.2726	0.4489
25	0.906	0.1371	0.2976	0.4847	0.1377	0.2996	0.4883	0.1383	0.3020	0.4925
30	0.866	0.1470	0.3199	0.5147	0.1471	0.3207	0.5162	0.1473	0.3216	0.5178
35	0.819	0.1528	0.3327	0.5274	0.1526	0.3325	0.5271	0.1524	0.3322	0.5266
40	0.766	0.1552	0.3364	0.5233	0.1548	0.3355	0.5218	0.1543	0.3343	0.5197
45	0.707	0.1549	0.3311	0.5030	0.1544	0.3298	0.5006	0.1539	0.3280	0.4976
50	0.643	0.1525	0.3170	0.4671	0.1520	0.3154	0.4643	0.1514	0.3133	0.4607
55	0.574	0.1481	0.2938	0.4166	0.1476	0.2921	0.4137	0.1470	0.2900	0.4100
60	0.500	0.1412	0.2613	0.3532	0.1407	0.2596	0.3505	0.1401	0.2576	0.3471
65	0.423	0.1308	0.2192	0.2800	0.1304	0.2178	0.2777	0.1299	0.2160	0.2748
70	0.342	0.1152	0.1683	0.2017	0.1148	0.1672	0.2000	0.1142	0.1658	0.1978
75	0.259	0.0914	0.1119	0.1254	0.0911	0.1111	0.1243	0.0906	0.1102	0.1229
80	0.174	0.0575	0.0571	0.0602	0.0573	0.0567	0.0596	0.0571	0.0562	0.0590
85	0.087	0.0191	0.0156	0.0158	0.0191	0.0155	0.0157	0.0190	0.0154	0.0155
90	0	0	0	0	0	0	0	0	0	0

TABLE 2.1

SHROUD THICKNESS RATIO AT PROPELLER PLANE t_p/c

$$t_p/c = \frac{1}{\lambda}\left(1 - \frac{\mu}{e}\right)$$

Accuracy: ± 0.0001

t_p/c, TABLE 2.1

TABLE 2.1

SHROUD THICKNESS RATIO AT PROPELLER PLANE t_p/c

	$\lambda=0.25$			$\lambda=0.50$			$\lambda=0.75$		
μ \ c	0.990	0.992	0.994	0.990	0.992	0.994	0.990	0.992	0.994
0.900	0.3636	0.3710	0.3783	0.1818	0.1855	0.1891	0.1212	0.1237	0.1261
0.940	0.2020	0.2097	0.2173	0.1010	0.1048	0.1087	0.0673	0.0699	0.0724
0.970	0.0808	0.0887	0.0966	0.0401	0.0444	0.0483	0.0269	0.0296	0.0322

TABLES 3.1 - 3.2

COEFFICIENTS OF SHROUD SOURCE STRENGTH DISTRIBUTIONS a_ν FOR NACA 4-, 5- AND 6-DIGIT AIRFOIL SECTIONS NORMALIZED SUCH THAT $t_m/c = 1$

See Ref. 5, Section 2.2. The coefficients for the NACA 4- and 5-digit airfoil sections are five times those given in Table 2.1. The coefficients for the 6-digit sections are obtained by assuming a thickness distribution of the same form and using a least-square curve fit to the appropriate data given in Ref. 13 .

Estimated Accuracy: ± 0.0001

TABLE 3.1

COEFFICIENTS OF SHROUD SOURCE STRENGTH DISTRIBUTIONS a_ν

ν	λ=0.25	λ=0.50	λ=0.75
0	1.0472	1.4845	1.8182
1	-3.1513	-3.1513	-3.1513
2	-3.0960	-1.5480	-1.0320
3	9.7560	2.4390	1.0840
4	-32.4800	-4.0600	-1.2030
5	0	0	0
6	0	0	0

TABLE 3.2

COEFFICIENTS OF SHROUD SOURCE STRENGTH DISTRIBUTIONS a_ν

63 FAMILY

ν	t_m/c = 0.06, λ=0.25	λ=0.50	λ=0.75	t_m/c = 0.12, λ=0.25	λ=0.50	λ=0.75	t_m/c = 0.18, λ=0.25	λ=0.50	λ=0.75
0	0.0516	0.0730	0.0894	0.1005	0.1421	0.1740	0.1424	0.2013	0.2466
1	-0.1748	-0.1748	-0.1748	-0.3533	-0.3533	-0.3533	-0.5271	-0.5271	-0.5271
2	-0.6197	-0.3098	-0.2066	-1.2200	-0.6100	-0.4067	-1.8420	-0.9210	-0.6140
3	1.4697	0.3674	0.1633	3.6248	0.9062	0.4028	6.5282	1.6321	0.7254
4	4.5892	0.5737	0.1700	9.4276	1.1784	0.3492	16.9198	2.1150	0.6267
5	-2.5641	-0.1603	-0.0317	-8.3377	-0.5211	-0.1029	-15.0303	-0.9394	-0.1856
6	68.0890	2.1278	0.2802	113.4300	3.5447	0.4668	78.8781	2.4649	0.3246

64 FAMILY

ν	t_m/c = 0.06, λ=0.25	λ=0.50	λ=0.75	t_m/c = 0.12, λ=0.25	λ=0.50	λ=0.75	t_m/c = 0.18, λ=0.25	λ=0.50	λ=0.75
0	0.0514	0.0727	0.0891	0.1013	0.1433	0.1755	0.1466	0.2074	0.2540
1	-0.1684	-0.1684	-0.1684	-0.3444	-0.3444	-0.3444	-0.5201	-0.5201	-0.5201
2	-0.7075	-0.3538	-0.2358	-1.3994	-0.6997	-0.4665	-2.0926	-1.0463	-0.6975
3	1.3901	0.3475	0.1545	3.6918	0.9230	0.4102	6.8083	1.7021	0.7565
4	7.6937	0.9617	0.2850	15.5607	1.9451	0.5763	23.9967	2.9996	0.8888
5	-7.9214	-0.4951	-0.0978	-24.7082	-1.5443	-0.3050	-47.1444	-2.9465	-0.5820
6	46.6991	1.4593	0.1922	82.0608	2.5644	0.3377	88.1598	2.7550	0.3628

65 FAMILY

ν	t_m/c = 0.06, λ=0.25	λ=0.50	λ=0.75	t_m/c = 0.12, λ=0.25	λ=0.50	λ=0.75	t_m/c = 0.18, λ=0.25	λ=0.50	λ=0.75
0	0.0485	0.0686	0.0841	0.0923	0.1305	0.1598	0.1317	0.1862	0.2281
1	-0.1461	-0.1461	-0.1461	-0.2914	-0.2914	-0.2914	-0.4381	-0.4381	-0.4381
2	-0.7996	-0.3998	-0.2665	-1.6734	-0.8367	-0.5578	-2.6054	-1.3027	-0.8685
3	0.2552	0.0638	0.0284	1.1361	0.2840	0.1262	2.9184	0.7296	0.3243
4	8.1053	1.0132	0.3002	21.0635	2.6329	0.7801	37.4508	4.6813	1.3871
5	4.4059	0.2754	0.0544	8.4025	0.5252	0.1037	5.8223	0.3639	0.0719
6	59.4996	1.8594	0.2449	34.8791	1.0900	0.1435	-47.9090	-1.4972	-0.1972

66 FAMILY

ν	t_m/c = 0.06, λ=0.25	λ=0.50	λ=0.75	t_m/c = 0.12, λ=0.25	λ=0.50	λ=0.75	t_m/c = 0.18, λ=0.25	λ=0.50	λ=0.75
0	0.0471	0.0666	0.0815	0.0904	0.1278	0.1565	0.1270	0.1796	0.2199
1	-0.1115	-0.1115	-0.1115	-0.2222	-0.2222	-0.2222	-0.3250	-0.3250	-0.3250
2	-0.6601	-0.3300	-0.2200	-1.4853	-0.7427	-0.4951	-2.4867	-1.2434	-0.8289
3	-2.6269	-0.6567	-0.2919	-4.9306	-1.2326	-0.5478	-7.0875	-1.7719	-0.7875
4	-6.7847	-0.8481	-0.2513	-3.8618	-0.4827	-0.1430	8.1730	1.0216	0.3027
5	42.5875	2.6617	0.5258	89.2344	5.5771	1.1017	146.1081	9.1318	1.8038
6	274.1910	8.5685	1.1284	415.8718	12.9960	1.7114	427.7375	13.3668	1.7602

TABLES 4.1 - 4.3

ELEMENTS FOR EVALUATION OF CAMBER INDUCED BY SHROUD THICKNESS $Q_{k,\ell}$

See Ref. 5, Section 2.8. These elements have been taken directly from Tables 2.11 - 2.13.

Accuracy: ± 0.0001

λ=0.25

TABLE 4.1

ELEMENTS FOR EVALUATION OF CAMBER INDUCED BY SHROUD THICKNESS $Q_{k,l}$

k \ l	0	1	2	3	4	5	6
0	0.7064	0.2499	0	0.0052	0	0.0002	0
1	-0.1527	0	0.0135	0	0.0005	0	0.0000
2	0.0167	0.0272	0	-0.0003	0	0.0000	0
3	-0.0041	0	-0.0027	0	0.0000	0	0.0000
4	0.0018	0.0026	0	0.0003	0	0.0000	0
5	-0.0009	0	-0.0004	0	0.0000	0	0.0000
6	0.0005	0.0008	0	0.0001	0	0.0000	0

λ=0.50

TABLE 4.2

ELEMENTS FOR EVALUATION OF CAMBER INDUCED BY SHROUD THICKNESS $Q_{k,l}$

k \ l	0	1	2	3	4	5	6
0	0.7698	0.3854	0	0.0320	0	0.0048	0
1	-0.2197	0	0.0551	0	0.0082	0	0.0015
2	0.0252	0.0557	0	-0.0026	0	-0.0009	0
3	-0.0052	0	-0.0109	0	-0.0004	0	0.0001
4	0.0023	0.0052	0	0.0025	0	0.0003	0
5	-0.0013	0	-0.0015	0	-0.0006	0	-0.0001
6	0.0007	0.0015	0	0.0005	0	0.0002	0

$\lambda = 0.75$

TABLE 4.3

ELEMENTS FOR EVALUATION OF CAMBER INDUCED BY SHROUD THICKNESS $Q_{k,l}$

k \ l	0	1	2	3	4	5	6
0	0.7784	0.4770	0	0.0893	0	0.0301	0
1	-0.2693	0	0.1244	0	0.0418	0	0.0168
2	0.0289	0.0835	0	-0.0091	0	-0.0066	0
3	-0.0054	0	-0.0252	0	-0.0023	0	0.0005
4	0.0032	0.0077	0	0.0085	0	0.0021	0
5	-0.0016	0	-0.0033	0	-0.0032	0	-0.0012
6	0.0008	0.0022	0	0.0015	0	0.0013	0

TABLES 5.1 - 5.3

TWO-DIMENSIONAL GLAUERT COEFFICIENTS OF GEOMETRIC CAMBER ϵ_ν FOR NACA 4-, 5- AND 6-DIGIT MEAN LINES

$$\epsilon_0 = \frac{2}{\pi}\int_0^\pi \epsilon(\phi)\, d\phi \quad ; \quad \epsilon_\nu = -\frac{4}{\pi}\int_0^\pi \epsilon(\phi) \cos \nu\phi \, d\phi \quad , \quad \nu = 1, 2, \dots 12$$

<u>NACA 4-Digit Mean Line For m = 1</u>

$$\epsilon(\phi) = (2p+\cos\phi)/(\tfrac{1}{2}+p)^2 \quad , \quad 0 \leq \phi \leq \cos^{-1}(-2p)$$

$$\epsilon(\phi) = (2p+\cos\phi)/(\tfrac{1}{2}-p)^2 \quad , \quad \cos^{-1}(-2p) \leq \phi \leq \pi$$

FOR $p = 0.40$, 0.30, 0.25, 0.20 OR 0.10, USE THE DATA FOR THE CORRESPONDING NEGATIVE VALUE OF p, WITH THE SIGN OF THE NUMBERS FOR $\nu = 0, 2, 4, 6, 8, 10$ AND 12 REVERSED.

NACA 5-Digit Mean Line

$$\epsilon(\phi) = \frac{k_1}{24}\left[3(1-\cos\phi)^2 - 12m(1-\cos\phi) + 4m^2(3-m)\right] \quad , \quad 0 \le \phi \le \cos^{-1}(1-2m)$$

$$\epsilon(\phi) = -\frac{k_1}{6}\, m^3 \quad , \quad \cos^{-1}(1-2m) \le \phi \le \pi$$

See Ref. 13, p. 116, for values of m and k_1.

NACA 6-Digit Mean Line For $c_{\ell_i} = 1$

$$\epsilon(\phi) = \frac{1}{2\pi(3+a)}\left[\frac{(1+\cos\phi)\ \ell n(1+\cos\phi)^2 - (2a+\cos\phi)\ \ell n(2a+\cos\phi)^2}{1-2a} - \ell n(\cos\phi-1)^2 - 2(1+h)\right]$$

$$h \equiv \frac{1}{(1-2a)}\left[(\tfrac{1}{2}-a)^2\ \ell n(\tfrac{1}{2}-a) - \tfrac{1}{2}(\tfrac{1}{2}-a)^2\right] + g$$

$$g \equiv \frac{1}{(1-2a)}\left[(\tfrac{1}{2}+a)^2\ \ell n(\tfrac{1}{2}+a) - \tfrac{1}{2}(\tfrac{1}{2}+a)^2 + \tfrac{1}{2}\right]$$

Accuracy: ± 0.001

TABLE 5.1

TWO-DIMENSIONAL GLAUERT COEFFICIENTS OF GEOMETRIC CAMBER ϵ_ν

ν	p=-0.40	p=-0.30	p=-0.25	p=-0.20	p=-0.10	p=0.00
0	3.382	1.760	1.323	0.982	0.449	0
1	-12.749	-9.799	-9.116	-8.659	-8.150	-8.000
2	-9.054	-5.093	-3.921	-2.964	-1.386	0
3	-7.243	-3.056	-1.960	-1.185	-0.277	0
4	-5.143	-1.182	-0.392	0.024	0.211	0
5	-3.071	0.073	0.392	0.408	0.149	0
6	-1.306	0.569	0.448	0.223	-0.048	0
7	-0.031	0.476	0.140	-0.070	-0.089	0
8	0.686	0.128	-0.140	-0.167	-0.001	0
9	0.897	-0.163	-0.196	-0.065	0.053	0
10	0.738	-0.241	-0.071	0.064	0.018	0
11	0.386	-0.133	0.071	0.086	-0.029	0
12	0.011	0.032	0.110	0.014	-0.022	0

TABLE 5.2

TWO-DIMENSIONAL GLAUERT COEFFICIENTS OF GEOMETRIC CAMBER ϵ_ν

ν	MEAN-LINE 210	MEAN-LINE 220	MEAN-LINE 230	MEAN-LINE 240	MEAN-LINE 250
0	0.076	0.065	0.057	0.050	0.044
1	-0.196	-0.192	-0.191	-0.191	-0.191
2	-0.187	-0.172	-0.158	-0.145	-0.129
3	-0.171	-0.141	-0.114	-0.087	-0.061
4	-0.151	-0.106	-0.068	-0.036	-0.013
5	-0.128	-0.070	-0.030	-0.005	0.005
6	-0.104	-0.039	-0.005	0.006	0.005
7	-0.080	-0.016	0.006	0.005	0.000
8	-0.057	-0.001	0.007	0.001	-0.002
9	-0.037	0.006	0.003	-0.002	0.000
10	-0.021	0.007	0.000	-0.002	0.001
11	-0.008	0.005	-0.002	0.000	0.001
12	0.000	0.002	-0.002	0.001	0.000

TABLE 5.3

TWO-DIMENSIONAL GLAUERT COEFFICIENTS OF GEOMETRIC CAMBER ϵ_ν

ν	a=-0.50	a=-0.40	a=-0.30	a=-0.20	a=-0.10	a=0.0	a=0.10	a=0.20	a=0.30	a=0.40	a=0.50
0	0.159	0.155	0.146	0.134	0.121	0.106	0.090	0.073	0.054	0.032	0
1	-0.637	-0.637	-0.637	-0.637	-0.637	-0.637	-0.637	-0.637	-0.637	-0.637	-0.637
2	-0.424	-0.417	-0.396	-0.366	-0.327	-0.283	-0.233	-0.180	-0.123	-0.063	0
3	-0.212	-0.198	-0.167	-0.130	-0.096	-0.071	-0.059	-0.065	-0.091	-0.140	-0.212
4	-0.170	-0.153	-0.126	-0.107	-0.103	-0.113	-0.130	-0.142	-0.136	-0.095	0
5	-0.127	-0.110	-0.092	-0.090	-0.097	-0.099	-0.087	-0.060	-0.034	-0.039	-0.127
6	-0.109	-0.093	-0.086	-0.090	-0.087	-0.073	-0.056	-0.054	-0.075	-0.088	0
7	-0.091	-0.078	-0.077	-0.075	-0.062	-0.051	-0.053	-0.063	-0.052	-0.022	-0.091
8	-0.081	-0.070	-0.071	-0.062	-0.052	-0.054	-0.058	-0.047	-0.035	-0.059	0
9	-0.071	-0.063	-0.061	-0.050	-0.049	-0.052	-0.042	-0.035	-0.046	-0.031	-0.071
10	-0.064	-0.059	-0.054	-0.047	-0.049	-0.043	-0.036	-0.043	-0.036	-0.032	0
11	-0.058	-0.054	-0.046	-0.045	-0.043	-0.035	-0.038	-0.035	-0.027	-0.036	-0.058
12	-0.053	-0.050	-0.043	-0.043	-0.036	-0.036	-0.036	-0.028	-0.035	-0.022	0

TABLES 6.1 - 6.18

TWO-DIMENSIONAL GLAUERT COEFFICIENTS OF PROPELLER INDUCED CAMBER $\epsilon_{\Gamma',\nu}$ FOR $C_T = 1$

$$\epsilon_{\Gamma',0} = \frac{2}{\pi}\int_0^{\pi} \epsilon_{\Gamma'}(\phi)\, d\phi \quad ; \quad \epsilon_{\Gamma',\nu} = -\frac{4}{\pi}\int_0^{\pi} \epsilon_{\Gamma'}(\phi) \cos \nu\phi \, d\phi \quad , \quad \nu = 1, 2, \ldots 12$$

$$\epsilon_{\Gamma'}(\phi) \equiv \frac{N\mu}{8\pi^2 J}\int_0^{\pi/2} \frac{\frac{\Gamma(\beta)}{R_p U} \sin\beta}{\sqrt{\mu\cos\beta}\,(\omega^2-1)} \left[(\mu\cos\beta+\omega)Q_{-\frac{1}{2}}(\omega) - (\omega\mu\cos\beta-1)Q_{\frac{1}{2}}(\omega)\right] d\beta$$

$$\omega \equiv 1 + \frac{\lambda^2(\cos\phi+2\chi)^2 + (1-\mu\cos\beta)^2}{2\mu\cos\beta}$$

Accuracy: ± 0.001

FOR $\chi = 0.25$, USE THE DATA FOR $\chi = -0.25$ WITH THE SIGN OF THE NUMBERS FOR $\nu = 1, 3, 5, 7, 9$ AND 11 REVERSED.

N = 3
e = 0.990
χ = -0.25

TABLE 6.1

TWO-DIMENSIONAL GLAUERT COEFFICIENTS OF PROPELLER INDUCED CAMBER $\epsilon_{\Gamma,\nu}$

μ=0.900

ν	λ=0.25 J=0.25	λ=0.25 J=0.50	λ=0.25 J=0.75	λ=0.50 J=0.25	λ=0.50 J=0.50	λ=0.50 J=0.75	λ=0.75 J=0.25	λ=0.75 J=0.50	λ=0.75 J=0.75
0	-0.255	-0.260	-0.264	-0.192	-0.194	-0.196	-0.153	-0.154	-0.155
1	0.078	0.084	0.039	0.101	0.105	0.108	0.102	0.104	0.106
2	-0.032	0.035	-0.036	-0.042	-0.044	-0.045	-0.044	-0.045	-0.046
3	-0.022	-0.024	-0.026	-0.045	-0.049	-0.052	-0.058	-0.062	-0.064
4	-0.003	-0.003	-0.003	-0.011	-0.013	-0.014	-0.018	-0.020	-0.021
5	0.004	0.004	0.005	0.009	0.010	0.011	0.013	0.014	0.015
6	0.002	0.003	0.003	0.010	0.011	0.012	0.017	0.019	0.021
7	0.000	0.000	0.000	0.003	0.003	0.003	0.005	0.006	0.007
8	-0.001	-0.001	-0.001	-0.003	-0.003	-0.004	-0.005	-0.006	-0.006
9	0.000	0.000	0.000	-0.003	-0.003	-0.004	-0.007	-0.007	-0.008
10	0.000	0.000	0 000	-0.001	-0.001	-0.001	-0.002	-0.002	-0.003
11	0.000	0.000	0.000	0.001	0.001	0.001	0.002	0.003	0.003
12	0.000	0.000	0.000	0.001	0.001	0.001	0.003	0.003	0.004

μ=0.940

ν	λ=0.25 J=0.25	λ=0.25 J=0.50	λ=0.25 J=0.75	λ=0.50 J=0.25	λ=0.50 J=0.50	λ=0.50 J=0.75	λ=0.75 J=0.25	λ=0.75 J=0.50	λ=0.75 J=0.75
0	-0.288	-0.294	-0.299	-0.213	-0.215	-0.217	-0.168	-0.169	-0.170
1	0.101	0.108	0.115	0.117	0.122	0.126	0.114	0.116	0.118
2	-0.042	-0.045	-0.048	-0.050	-0.053	-0.055	-0.051	-0.053	-0.055
3	-0.036	-0.040	-0.044	-0.060	-0.066	-0.070	-0.071	-0.076	-0.080
4	-0.007	-0.008	-0.009	-0.018	-0.020	-0.022	-0.024	-0.026	-0.028
5	0.007	0.008	0.009	0.014	0.015	0.016	0.018	0.019	0.020
6	0.006	0.007	0.008	0.018	0.020	0.022	0.025	0.028	0.030
7	0.001	0.001	0.002	0.006	0.006	0.007	0.009	0.010	0.011
8	-0.002	-0.002	-0.002	-0.005	-0.006	-0.006	-0.008	-0.009	-0.010
9	-0.002	-0.002	-0.002	-0.007	-0.008	-0.009	-0.012	-0.013	-0.014
10	0.000	0.000	0.000	-0.002	-0.003	-0.003	-0.004	-0.005	-0.005
11	0.001	0.001	0.001	0.002	0.003	0.003	0.004	0.005	0.005
12	0.000	0.001	0.001	0.003	0.004	0.004	0.006	0.007	0.008

μ=0.970

ν	λ=0.25 J=0.25	λ=0.25 J=0.50	λ=0.25 J=0.75	λ=0.50 J=0.25	λ=0.50 J=0.50	λ=0.50 J=0.75	λ=0.75 J=0.25	λ=0.75 J=0.50	λ=0.75 J=0.75
0	-0.315	-0.322	-0.328	-0.229	-0.232	-0.234	-0.180	-0.181	-0.182
1	0.121	0.131	0.139	0.130	0.135	0.140	0.123	0.126	0.129
2	-0.052	-0.056	-0.060	-0.058	-0.061	-0.064	-0.058	-0.060	-0.062
3	-0.054	-0.060	-0.066	-0.075	-0.082	-0.088	-0.084	-0.090	-0.095
4	-0.015	-0.016	-0.018	-0.025	-0.027	-0.030	-0.030	-0.032	-0.035
5	0.012	0.013	0.015	0.019	0.021	0.022	0.022	0.024	0.026
6	0.014	0.016	0.018	0.027	0.030	0.033	0.034	0.038	0.041
7	0.004	0.005	0.006	0.010	0.011	0.012	0.013	0.015	0.016
8	-0.004	-0.005	-0.005	-0.008	-0.009	-0.011	-0.011	-0.012	-0.013
9	-0.005	-0.006	-0.007	-0.013	-0.014	-0.016	-0.018	-0.020	-0.022
10	-0.002	-0.002	-0.002	-0.005	-0.006	-0.006	-0.007	-0.008	-0.009
11	0.002	0.002	0.002	0.005	0.005	0.006	0.006	0.007	0.008
12	0.002	0.003	0.003	0.007	0.008	0.009	0.011	0.012	0.013

μ=0.990

ν	λ=0.25 J=0.25	λ=0.25 J=0.50	λ=0.25 J=0.75	λ=0.50 J=0.25	λ=0.50 J=0.50	λ=0.50 J=0.75	λ=0.75 J=0.25	λ=0.75 J=0.50	λ=0.75 J=0.75
0	-0.334	-0.342	-0.349	-0.240	-0.243	-0.245	-0.188	-0.189	-0.190
1	0.136	0.147	0.156	0.139	0.145	0.150	0.130	0.133	0.135
2	-0.061	-0.067	-0.071	-0.065	-0.068	-0.071	-0.062	-0.065	-0.067
3	-0.071	-0.080	-0.087	-0.087	-0.096	-0.103	-0.092	-0.099	-0.104
4	-0.022	-0.025	-0.028	-0.030	-0.034	-0.037	-0.034	-0.037	-0.040
5	0.017	0.020	0.022	0.023	0.026	0.028	0.026	0.028	0.030
6	0.025	0.029	0.032	0.036	0.040	0.044	0.041	0.045	0.049
7	0.009	0.010	0.012	0.014	0.016	0.017	0.017	0.019	0.020
8	-0.008	-0.009	-0.010	-0.012	-0.013	-0.015	-0.014	-0.016	-0.017
9	-0.012	-0.014	-0.016	-0.020	-0.022	-0.025	-0.024	-0.027	-0.029
10	-0.005	-0.006	-0.006	-0.008	-0.009	-0.010	-0.010	-0.011	-0.012
11	0.004	0.005	0.006	0.007	0.008	0.009	0.009	0.010	0.011
12	0.007	0.008	0.009	0.012	0.014	0.016	0.016	0.018	0.019

N = 4
e = 0.990
χ = -0.25

TABLE 6.2

TWO-DIMENSIONAL GLAUERT COEFFICIENTS OF PROPELLER INDUCED CAMBER $\epsilon_{\Gamma,\nu}$

μ=0.900

	λ=0.25			λ=0.50			λ=0.75		
ν	J=0.25	J=0.50	J=0.75	J=0.25	J=0.50	J=0.75	J=0.25	J=0.50	J=0.75
0	-0.256	-0.260	-0.264	-0.193	-0.195	-0.196	-0.153	-0.154	-0.155
1	0.079	0.085	0.089	0.102	0.106	0.109	0.102	0.104	0.106
2	-0.033	-0.035	-0.036	-0.042	-0.044	-0.045	0.044	-0.045	-0.046
3	-0.022	-0.025	-0.027	-0.046	-0.050	-0.053	-0.059	-0.062	-0.065
4	-0.003	-0.003	-0.004	-0.012	-0.013	-0.014	-0.018	-0.020	-0.021
5	0.004	0.004	0.005	0.010	0.010	0.011	0.014	0.015	0.015
6	0.002	0.003	0.003	0.010	0.012	0.013	0.018	0.019	0.021
7	0.000	0.000	0.000	0.003	0.003	0.003	0.006	0.006	0.007
8	-0.001	-0.001	-0.001	-0.003	-0.003	-0.004	-0.005	-0.006	-0.006
9	0.000	0.000	0.000	-0.003	-0.003	-0.004	-0.007	-0.008	-0.008
10	0.000	0.000	0.000	-0.001	-0.001	-0.001	-0.002	-0.002	-0.003
11	0.000	0.000	0.000	0.001	0.001	0.001	0.002	0.003	0.003
12	0.000	0.000	0.000	0.001	0.001	0.001	0.003	0.003	0.004

μ=0.940

	λ=0.25			λ=0.50			λ=0.75		
ν	J=0.25	J=0.50	J=0.75	J=0.25	J=0.50	J=0.75	J=0.25	J=0.50	J=0.75
0	-0.289	-0.295	-0.299	-0.213	-0.215	-0.217	-0.168	-0.169	-0.170
1	0.102	0.109	0.116	0.118	0.123	0.126	0.114	0.117	0.119
2	-0.042	-0.045	-0.048	-0.051	-0.053	-0.055	-0.052	-0.053	-0.055
3	-0.037	-0.041	-0.044	-0.062	-0.066	-0.071	-0.072	-0.077	-0.080
4	-0.008	-0.008	-0.009	-0.018	-0.020	-0.022	-0.024	-0.026	-0.028
5	0.007	0.008	0.009	0.014	0.015	0.017	0.018	0.019	0.021
6	0.007	0.007	0.008	0.018	0.020	0.022	0.026	0.028	0.031
7	0.001	0.001	0.002	0.006	0.006	0.007	0.009	0.010	0.011
8	-0.002	-0.002	-0.002	-0.005	-0.006	-0.006	-0.008	-0.009	-0.010
9	-0.002	-0.002	-0.002	-0.007	-0.008	-0.009	-0.012	-0.013	-0.014
10	0.000	0.000	0.000	-0.002	-0.003	-0.003	-0.004	-0.005	-0.005
11	0.001	0.001	0.001	0.002	0.003	0.003	0.004	0.005	0.005
12	0.000	0.001	0.001	0.003	0.004	0.004	0.006	0.007	0.008

μ=0.970

	λ=0.25			λ=0.50			λ=0.75		
ν	J=0.25	J=0.50	J=0.75	J=0.25	J=0.50	J=0.75	J=0.25	J=0.50	J=0.75
0	-0.316	-0.323	-0.329	-0.229	-0.232	-0.234	-0.180	-0.181	-0.182
1	0.123	0.132	0.140	0.130	0.136	0.140	0.124	0.127	0.129
2	-0.053	-0.057	-0.060	-0.059	-0.062	-0.064	-0.058	-0.060	-0.062
3	-0.055	-0.061	-0.066	-0.077	-0.083	-0.088	-0.085	-0.090	-0.095
4	-0.015	-0.017	-0.019	-0.025	-0.028	-0.030	-0.030	-0.033	-0.035
5	0.012	0.013	0.015	0.019	0.021	0.022	0.022	0.024	0.026
6	0.015	0.017	0.018	0.028	0.030	0.033	0.035	0.038	0.041
7	0.005	0.005	0.006	0.010	0.011	0.012	0.013	0.015	0.016
8	-0.004	-0.005	-0.005	-0.009	-0.010	-0.011	-0.011	-0.012	-0.014
9	-0.006	-0.006	-0.007	-0.013	-0.015	-0.016	-0.018	-0.020	-0.022
10	-0.002	-0.002	-0.002	-0.005	-0.006	-0.006	-0.007	-0.008	-0.009
11	0.002	0.002	0.002	0.005	0.005	0.006	0.007	0.007	0.008
12	0.002	0.003	0.003	0.007	0.008	0.009	0.011	0.012	0.013

μ=0.990

	λ=0.25			λ=0.50			λ=0.75		
ν	J=0.25	J=0.50	J=0.75	J=0.25	J=0.50	J=0.75	J=0.25	J=0.50	J=0.75
0	-0.335	-0.343	-0.349	-0.240	-0.243	-0.245	-0.189	-0.188	-0.190
1	0.138	0.148	0.157	0.140	0.145	0.150	0.133	0.130	0.136
2	-0.062	-0.067	-0.071	10.065	-0.069	-0.071	-0.065	-0.063	-0.067
3	-0.073	-0.081	-0.088	-0.089	-0.096	-0.103	-0.100	-0.094	-0.105
4	-0.023	-0.026	-0.028	-0.031	-0.034	-0.037	-0.038	-0.035	-0.040
5	0.018	0.020	0.022	0.024	0.026	0.028	0.028	0.026	0.030
6	0.026	0.029	0.032	0.037	0.040	0.044	0.046	0.042	0.049
7	0.009	0.011	0.012	0.014	0.016	0.018	0.019	0.017	0.020
8	-0.008	-0.009	-0.010	-0.012	-0.014	-0.015	-0.016	-0.014	-0.017
9	-0.013	-0.014	-0.016	-0.020	-0.022	-0.025	-0.327	-0.024	-0.029
10	-0.005	-0.006	-0.006	-0.008	-0.009	-0.010	-0.011	-0.010	-0.013
11	0.005	0.005	0.006	0.008	0.008	0.009	0.010	0.009	0.011
12	0.007	0.008	0.009	0.013	0.014	0.016	0.017	0.016	0.020

N=6
e = 0.990
χ = -0.25

TABLE 6.3

TWO-DIMENSIONAL GLAUERT COEFFICIENTS OF PROPELLER INDUCED CAMBER $\epsilon_{\Gamma',\nu}$

μ=0.900

	λ=0.25			λ=0.50			λ=0.75		
ν	J=0.25	J=0.50	J=0.75	J=0.25	J=0.50	J=0.75	J=0.25	J=0.50	J=0.75
0	-0.257	-0.261	-0.265	-0.193	-0.195	-0.196	-0.154	-0.154	-0.155
1	0.081	0.086	0.090	0.103	0.106	0.109	0.103	0.105	0.106
2	-0.033	-0.035	-0.037	-0.043	-0.044	-0.045	-0.044	-0.046	-0.047
3	-0.023	-0.025	-0.027	-0.047	-0.050	-0.053	-0.060	-0.063	-0.065
4	-0.003	-0.003	-0.004	-0.012	-0.013	-0.014	-0.019	-0.020	-0.022
5	0.003	0.004	0.005	0.010	0.011	0.011	0.014	0.015	0.016
6	0.003	0.003	0.003	0.011	0.012	0.013	0.018	0.020	0.021
7	0.000	0.000	0.000	0.003	0.003	0.003	0.006	0.006	0.007
8	-0.001	-0.001	-0.001	-0.003	-0.003	-0.004	-0.005	-0.006	-0.006
9	0.000	0.000	0.000	-0.003	-0.004	-0.004	-0.007	-0.008	-0.008
10	0.000	0.000	0.000	-0.001	-0.001	-0.001	-0.002	-0.002	-0.003
11	0.000	0.000	0.000	0.001	0.001	0.001	0.002	0.003	0.003
12	0.000	0.000	0.000	0.001	0.001	0.001	0.003	0.003	0.004

μ=0.940

	λ=0.25			λ=0.50			λ=0.75		
ν	J=0.25	J=0.50	J=0.75	J=0.25	J=0.50	J=0.75	J=0.25	J=0.50	J=0.75
0	-0.291	-0.296	-0.300	-0.214	-0.216	-0.217	-0.169	-0.170	-0.170
1	0.105	0.111	0.117	0.119	0.124	0.127	0.115	0.117	0.119
2	-0.043	-0.046	-0.048	-0.052	-0.053	-0.055	-0.052	-0.054	-0.055
3	-0.039	-0.042	-0.045	-0.063	-0.068	-0.071	-0.074	-0.078	-0.081
4	-0.008	-0.009	-0.010	-0.019	-0.021	-0.022	-0.025	-0.027	-0.029
5	0.007	0.008	0.009	0.015	0.016	0.017	0.018	0.020	0.021
6	0.007	0.008	0.008	0.019	0.020	0.022	0.027	0.029	0.031
7	0.001	0.002	0.002	0.006	0.007	0.007	0.010	0.011	0.012
8	-0.002	-0.002	-0.002	-0.006	-0.006	-0.007	-0.008	-0.009	-0.010
9	-0.002	-0.002	-0.002	-0.007	-0.008	-0.009	-0.013	-0.014	-0.015
10	0.000	0.000	0.000	-0.002	-0.003	-0.003	-0.005	-0.005	-0.006
11	0.001	0.001	0.001	0.003	0.003	0.003	0.004	0.005	0.005
12	0.001	0.001	0.001	0.003	0.004	004	0.007	0.007	0.008

μ=0.970

	λ=0.25			λ=0.50			λ=0.75		
ν	J=0.25	J=0.50	J=0.75	J=0.25	J=0.50	J=0.75	J=0.25	J=0.50	J=0.75
0	-0.318	-0.324	-0.330	-0.230	-0.232	-0.234	-0.180	-0.181	-0.182
1	0.126	0.134	0.141	0.132	0.137	0.141	0.125	0.127	0.129
2	-0.054	-0.057	-0.061	-0.060	-0.062	-0.065	-0.059	-0.061	-0.062
3	-0.058	-0.062	-0.068	-0.079	-0.084	-0.090	-0.087	-0.092	-0.096
4	-0.016	-0.017	-0.019	-0.026	-0.028	-0.031	-0.031	-0.033	-0.036
5	0.013	0.014	0.015	0.020	0.021	0.023	0.023	0.025	0.026
6	0.016	0.017	0.019	0.029	0.031	0.034	0.036	0.039	0.042
7	0.005	0.005	0.006	0.011	0.011	0.013	0.014	0.015	0.016
8	-0.005	-0.005	-0.005	-0.009	-0.010	-0.011	-0.012	-0.013	-0.014
9	-0.006	-0.007	-0.007	-0.014	-0.015	-0.017	-0.019	-0.021	-0.022
10	-0.002	-0.002	-0.002	-0.005	-0.006	-0.006	-0.008	-0.008	-0.009
11	0.002	0.002	0.002	0.005	0.005	0.006	0.007	0.008	0.008
12	0.003	0.003	0.003	0.008	0.008	0.009	0.012	0.013	0.014

μ=0.990

	λ=0.25			λ=0.50			λ=0.75		
ν	J=0.25	J=0.50	J=0.75	J=0.25	J=0.50	J=0.75	J=0.25	J=0.50	J=0.75
0	-0.338	-0.345	-0.350	0.241	-0.244	-0.246	-0.188	-0.189	-0.190
1	0.142	0.151	0.159	0.141	0.147	0.151	0.131	0.134	0.136
2	-0.064	-0.068	-0.072	-0.066	-0.069	-0.072	-0.064	-0.066	-0.068
3	-0.076	-0.083	-0.090	-0.092	-0.098	-0.104	-0.096	-0.101	-0.106
4	-0.024	-0.026	-0.029	-0.032	-0.035	-0.038	-0.036	-0.038	-0.041
5	0.019	0.021	0.022	0.025	0.027	0.028	0.027	0.029	0.031
6	0.028	0.030	0.033	0.038	0.042	0.045	0.043	0.047	0.050
7	0.010	0.011	0.012	0.015	0.016	0.018	0.018	0.019	0.021
8	-0.009	-0.010	-0.011	-0.013	-0.014	-0.015	-0.015	-0.016	-0.018
9	-0.014	-0.015	-0.017	-0.021	-0.023	-0.025	-0.025	-0.028	-0.030
10	-0.005	-0.006	-0.007	-0.009	-0.010	-0.011	-0.011	-0.012	-0.013
11	0.005	0.005	0.006	0.009	0.009	0.010	0.010	0.011	0.011
12	0.008	0.009	0.010	0.014	0.015	0.016	0.017	0.018	0.020

N= 3
e = 0.992
χ = -0.25

TABLE 6.4

TWO-DIMENSIONAL GLAUERT COEFFICIENTS OF PROPELLER INDUCED CAMBER $\epsilon_{T',\nu}$

μ=0.900

	λ=0.25			λ=0.50			λ=0.75		
ν	J=0.25	J=0.50	J=0.75	J=0.25	J=0.50	J=0.75	J=0.25	J=0.50	J=0.75
0	-0.255	-0.260	-0.264	-0.192	-0.194	-0.196	-0.153	-0.155	-0.154
1	0.079	0.085	0.090	0.101	0.105	0.109	0.102	0.106	0.104
2	-0.032	-0.035	-0.037	-0.042	-0.044	-0.045	-0.044	-0.046	-0.045
3	-0.022	-0.025	-0.027	-0.046	-0.050	-0.053	-0.058	-0.065	-0.062
4	-0.003	-0.003	-0.004	-0.011	-0.013	-0.014	-0.018	-0.021	-0.020
5	0.004	0.004	0.005	0.010	0.010	0.011	0.013	0.015	0.015
6	0.002	0.003	0.003	0.010	0.012	0.013	0.017	0.021	0.019
7	0.000	0.000	0.000	0.003	0.003	0.003	0.006	0.007	0.006
8	-0.001	-0.001	-0.001	-0.003	-0.003	-0.004	-0.005	-0.006	-0.006
9	0.000	0.000	0.000	-0.003	-0.004	-0.004	-0.007	-0.008	-0.008
10	0.000	0.000	0.000	-0.001	-0.001	-0.001	-0.002	-0.003	-0.002
11	0.000	0.000	0.000	0.001	0.001	0.001	0.002	0.003	0.003
12	0.000	0.000	0.000	0.001	0.001	0.001	0.003	0.004	0.003

μ=0.940

	λ=0.25			λ=0.50			λ=0.75		
ν	J=0.25	J=0.50	J=0.75	J=0.25	J=0.50	J=0.75	J=0.25	J=0.50	J=0.75
0	-0.288	-0.295	-0.300	-0.213	-0.215	-0.217	-0.168	-0.169	-0.170
1	0.101	0.109	0.116	0.117	0.122	0.126	0.114	0.117	0.119
2	-0.042	-0.045	-0.048	-0.052	-0.053	-0.055	-0.051	-0.053	-0.055
3	-0.037	-0.041	-0.045	-0.061	-0.066	-0.071	-0.072	-0.077	-0.080
4	-0.007	-0.009	-0.010	-0.018	-0.020	-0.022	-0.024	-0.026	-0.028
5	0.007	0.008	0.009	0.014	0.015	0.017	0.018	0.019	0.021
6	0.007	0.007	0.008	0.018	0.020	0.022	0.026	0.028	0.031
7	0.001	0.002	0.002	0.006	0.006	0.007	0.009	0.010	0.011
8	-0.002	-0.002	-0.002	-0.005	-0.006	-0.007	-0.008	-0.009	-0.010
9	-0.002	-0.002	-0.002	-0.007	-0.008	-0.009	-0.012	-0.013	-0.015
10	0.000	0.000	0.000	-0.002	-0.003	-0.003	-0.004	-0.005	-0.005
11	0.001	0.001	0.001	0.002	0.002	0.003	0.004	0.005	0.005
12	0.000	0.001	0.001	0.003	0.004	0.004	0.006	0.007	0.008

μ=0.970

	λ=0.25			λ=0.50			λ=0.75		
ν	J=0.25	J=0.50	J=0.75	J=0.25	J=0.50	J=0.75	J=0.25	J=0.50	J=0.75
0	-0.315	-0.323	-0.329	-0.229	-0.232	-0.234	-0.180	-0.181	-0.182
1	0.122	0.132	0.140	0.130	0.136	0.140	0.124	0.127	0.129
2	-0.052	-0.057	-0.060	-0.059	-0.062	-0.064	-0.058	-0.060	-0.062
3	-0.055	-0.061	-0.067	-0.076	-0.083	-0.089	-0.084	-0.090	-0.095
4	-0.015	-0.017	-0.019	-0.025	-0.028	-0.030	-0.030	-0.033	-0.035
5	0.012	0.014	0.015	0.019	0.021	0.023	0.022	0.024	0.026
6	0.015	0.017	0.019	0.027	0.031	0.033	0.034	0.038	0.041
7	0.004	0.005	0.006	0.010	0.011	0.012	0.013	0.015	0.016
8	-0.004	-0.005	-0.005	-0.009	-0.010	0.011	-0.011	-0.012	-0.014
9	-0.006	-0.006	-0.007	-0.013	-0.015	-0.016	-0.018	-0.020	-0.022
10	-0.002	-0.002	-0.002	-0.005	-0.006	-0.006	-0.007	-0.008	-0.009
11	0.002	0.002	0.002	0.005	0.005	0.006	0.007	0.007	0.008
12	0.002	0.003	0.003	0.007	0.008	0.009	0.011	0.012	0.014

μ 0.992

	λ=0.25			λ=0.50			λ=0.75		
ν	J=0.25	J=0.50	J=0.75	J=0.25	J=0.50	J=0.75	J=0.25	J=0.50	J=0.75
0	-0.336	-0.345	-0.352	-0.241	-0.244	-0.247	-0.189	-0.190	-0.191
1	0.138	0.150	0.159	0.140	0.146	0.151	0.131	0.134	0.136
2	-0.063	-0.068	-0.073	-0.066	-0.069	-0.072	-0.063	-0.066	-0.068
3	-0.075	-0.084	-0.092	-0.089	-0.098	-0.105	-0.094	-0.101	-0.106
4	-0.024	-0.027	-0.030	-0.031	-0.035	-0.038	-0.035	-0.038	-0.041
5	0.019	0.021	0.023	0.024	0.027	0.029	0.026	0.029	0.031
6	0.027	0.031	0.035	0.037	0.042	0.046	0.042	0.047	0.051
7	0.010	0.012	0.013	0.015	0.017	0.018	0.017	0.019	0.021
8	-0.009	-0.010	-0.011	-0.013	-0.014	-0.016	-0.015	-0.016	-0.018
9	-0.014	-0.016	-0.018	-0.021	-0.024	-0.027	-0.025	-0.028	-0.031
10	-0.006	-0.006	-0.007	-0.009	-0.010	-0.011	-0.010	-0.012	-0.013
11	0.005	0.006	0.007	0.008	0.009	0.010	0.009	0.011	0.012
12	0.008	0.010	0.011	0.014	0.015	0.017	0.016	0.019	0.021

N=4
e = 0.992
χ = -0.25

TABLE 6.3

TWO-DIMENSIONAL GLAUERT COEFFICIENTS OF PROPELLER INDUCED CAMBER $\epsilon_{\Gamma',\nu}$

μ=0.900

	λ=0.25			λ=0.50			λ=0.75		
ν	J=0.25	J=0.50	J=0.75	J=0.25	J=0.50	J=0.75	J=0.25	J=0.50	J=0.75
0	-0.256	-0.261	-0.265	-0.193	-0.195	-0.196	-0.153	-0.154	-0.155
1	0.080	0.085	0.090	0.102	0.106	0.109	0.102	0.105	0.106
2	-0.033	-0.035	-0.037	-0.042	-0.044	-0.045	-0.044	-0.045	-0.047
3	-0.023	-0.025	-0.027	-0.046	-0.050	-0.053	-0.059	-0.062	-0.065
4	-0.003	-0.003	-0.004	-0.012	-0.013	-0.014	-0.018	-0.020	-0.021
5	0.004	0.004	0.005	0.010	0.011	0.011	0.014	0.015	0.016
6	0.002	0.003	0.003	0.011	0.012	0.013	0.018	0.019	0.021
7	0.000	0.000	0.000	0.003	0.003	0.003	0.006	0.006	0.007
8	-0.001	-0.001	-0.001	-0.003	-0.003	-0.004	-0.005	-0.006	-0.006
9	0.000	0.000	0.000	-0.003	-0.004	-0.004	-0.007	-0.008	-0.008
10	0.000	0.000	0.000	-0.001	-0.001	-0.001	-0.002	-0.002	-0.003
11	0.000	0.000	0.000	0.001	0.001	0.001	0.002	0.003	0.003
12	0.000	0.000	0.000	0.001	0.001	0.001	0.003	0.003	0.004

μ=0.940

	λ=0.25			λ=0.50			λ=0.75		
ν	J=0.25	J=0.50	J=0.75	J=0.25	J=0.50	J=0.75	J=0.25	J=0.50	J=0.75
0	-0.289	-0.295	-0.300	-0.213	-0.216	-0.217	-0.168	-0.169	-0.170
1	0.103	0.110	0.116	0.118	0.123	0.127	0.114	0.117	0.119
2	-0.043	-0.046	-0.048	-0.051	-0.053	-0.055	-0.052	-0.053	-0.055
3	-0.037	-0.041	-0.045	-0.062	-0.067	-0.071	-0.073	-0.077	-0.081
4	-0.008	-0.009	-0.010	-0.018	-0.020	-0.022	-0.024	-0.027	-0.029
5	0.007	0.008	0.009	0.014	0.015	0.017	0.018	0.019	0.021
6	0.007	0.008	0.008	0.018	0.020	0.022	0.026	0.029	0.031
7	0.001	0.002	0.002	0.006	0.006	0.007	0.009	0.010	0.011
8	-0.002	-0.002	-0.002	-0.005	-0.006	-0.007	-0.008	-0.009	-0.010
9	-0.002	-0.002	-0.002	-0.007	-0.008	-0.009	-0.012	-0.013	-0.015
10	0.000	0.000	0.000	-0.002	-0.003	-0.003	-0.004	-0.005	-0.006
11	0.001	0.001	0.001	0.002	0.003	0.003	0.004	0.005	0.005
12	0.000	0.001	0.001	0.003	0.004	0.004	0.006	0.007	0.008

μ=0.970

	λ=0.25			λ=0.50			λ=0.75		
ν	J=0.25	J=0.50	J=0.75	J=0.25	J=0.50	J=0.75	J=0.25	J=0.50	J=0.75
0	-0.317	-0.324	-0.329	-0.229	-0.232	-0.234	-0.180	-0.181	-0.182
1	0.124	0.132	0.141	0.131	0.136	0.140	0.124	0.127	0.129
2	-0.053	-0.057	-0.060	-0.059	-0.062	-0.065	-0.058	-0.060	-0.062
3	-0.056	-0.062	-0.067	-0.077	-0.083	-0.089	-0.085	-0.091	-0.095
4	-0.015	-0.017	-0.019	-0.025	-0.028	-0.031	-0.030	-0.033	-0.035
5	0.012	0.014	0.015	0.019	0.021	0.023	0.023	0.024	0.026
6	0.015	0.017	0.019	0.028	0.031	0.034	0.035	0.038	0.042
7	0.005	0.005	0.006	0.010	0.011	0.012	0.013	0.015	0.016
8	-0.004	-0.005	-0.006	-0.009	-0.010	-0.011	-0.011	-0.013	-0.014
9	-0.006	-0.006	-0.007	-0.013	-0.015	-0.017	-0.018	-0.020	-0.022
10	-0.002	-0.002	-0.003	-0.005	-0.006	-0.006	-0.008	-0.008	-0.009
11	0.002	0.002	0.002	0.005	0.005	0.006	0.007	0.007	0.008
12	0.003	0.003	0.003	0.007	0.008	0.009	0.011	0.012	0.014

μ=0.992

	λ=0.25			λ=0.50			λ=0.75		
ν	J=0.25	J=0.50	J=0.75	J=0.25	J=0.50	J=0.75	J=0.25	J=0.50	J=0.75
0	-0.338	-0.346	-0.352	-0.242	-0.245	-0.247	-0.189	-0.190	-0.191
1	0.140	0.151	0.160	0.141	0.147	0.151	0.131	0.134	0.137
2	-0.064	-0.069	-0.073	-0.066	-0.070	-0.073	-0.064	-0.066	-0.068
3	-0.076	-0.984	-0.092	-0.091	-0.098	-0.105	-0.095	-0.101	-0.107
4	-0.024	-0.027	-0.030	-0.032	-0.035	-0.038	-0.035	-0.038	-0.041
5	0.019	0.021	0.023	0.024	0.027	0.029	0.027	0.029	0.031
6	0.028	0.031	0.035	0.038	0.042	0.046	0.043	0.047	0.051
7	0.010	0.012	0.013	0.015	0.017	0.018	0.017	0.019	0.021
8	-0.009	-0.010	-0.011	-0.013	-0.014	-0.016	-0.015	-0.016	-0.018
9	-0.014	-0.016	-0.018	-0.021	-0.024	-0.027	-0.025	-0.028	-0.031
10	-0.006	-0.006	-0.007	-0.009	-0.010	-0.011	-0.011	-0.012	-0.013
11	0.005	0.006	0.007	0.008	0.009	0.010	0.010	0.011	0.012
12	0.009	0.010	0.011	0.014	0.015	0.017	0.017	0.019	0.021

N = 6
e = 0.992
χ = -0.25

TABLE 6.6

TWO-DIMENSIONAL GLAUERT COEFFICIENTS OF PROPELLER INDUCED CAMBER $c_{\Gamma',\nu}$

μ = 0.900

ν	λ=0.25 J=0.25	λ=0.25 J=0.50	λ=0.25 J=0.75	λ=0.50 J=0.25	λ=0.50 J=0.50	λ=0.50 J=0.75	λ=0.75 J=0.25	λ=0.75 J=0.50	λ=0.75 J=0.75
0	-0.257	-0.262	-0.265	-0.193	-0.195	-0.196	-0.154	-0.154	-0.155
1	0.082	0.086	0.091	0.103	0.107	0.109	0.103	0.105	0.106
2	-0.034	-0.035	-0.037	-0.043	-0.044	-0.046	-0.045	-0.046	-0.047
3	-0.024	-0.025	-0.027	-0.048	-0.051	-0.054	-0.060	-0.063	-0.066
4	-0.003	-0.003	-0.004	-0.012	-0.013	-0.014	-0.019	-0.020	-0.022
5	0.004	0.004	0.005	0.010	0.011	0.011	0.014	0.015	0.016
6	0.003	0.003	0.003	0.011	0.012	0.013	0.018	0.020	0.021
7	0.000	0.000	0.000	0.003	0.003	0.003	0.006	0.006	0.007
8	-0.001	-0.001	-0.001	-0.003	-0.003	-0.004	-0.005	-0.006	-0.006
9	0.000	0.000	0.000	-0.003	-0.004	-0.004	-0.007	-0.008	-0.008
10	0.000	0.000	0.000	-0.001	-0.001	-0.001	-0.002	-0.003	-0.003
11	0.000	0.000	0.000	0.001	0.001	0.001	0.002	0.003	0.003
12	0.000	0.000	0.000	0.001	0.001	0.001	0.003	0.003	0.004

μ = 0.940

ν	λ=0.25 J=0.25	λ=0.25 J=0.50	λ=0.25 J=0.75	λ=0.50 J=0.25	λ=0.50 J=0.50	λ=0.50 J=0.75	λ=0.75 J=0.25	λ=0.75 J=0.50	λ=0.75 J=0.75
0	-0.291	-0.296	-0.301	-0.214	-0.216	-0.218	-0.169	-0.170	-0.170
1	0.105	0.112	0.117	0.119	0.124	0.127	0.115	0.117	0.119
2	-0.044	-0.046	-0.048	-0.052	-0.054	-0.055	-0.052	-0.054	-0.055
3	-0.039	-0.042	-0.046	-0.064	-0.068	-0.072	-0.074	-0.078	-0.081
4	-0.008	-0.009	-0.010	-0.019	-0.021	-0.023	-0.025	-0.027	-0.029
5	0.008	0.008	0.009	0.015	0.016	0.017	0.019	0.020	0.021
6	0.007	0.008	0.009	0.019	0.021	0.022	0.027	0.029	0.031
7	0.001	0.002	0.002	0.006	0.007	0.007	0.010	0.011	0.012
8	-0.002	-0.002	-0.002	-0.006	-0.006	-0.007	-0.008	-0.009	-0.010
9	-0.002	-0.002	-0.002	-0.008	-0.008	-0.009	-0.013	-0.014	-0.015
10	0.000	0.000	0.000	-0.002	-0.003	-0.003	-0.005	-0.005	-0.006
11	0.001	0.001	0.001	0.003	0.003	0.003	0.004	0.005	0.005
12	0.001	0.001	0.001	0.003	0.004	0.004	0.007	0.007	0.008

μ = 0.970

ν	λ=0.25 J=0.25	λ=0.25 J=0.50	λ=0.25 J=0.75	λ=0.50 J=0.25	λ=0.50 J=0.50	λ=0.50 J=0.75	λ=0.75 J=0.25	λ=0.75 J=0.50	λ=0.75 J=0.75
0	-0.319	-0.325	-0.330	-0.230	-0.233	-0.234	-0.180	-0.181	-0.182
1	0.127	0.135	0.142	0.132	0.137	0.141	0.125	0.127	0.129
2	-0.054	-0.058	-0.061	-0.060	-0.063	-0.065	-0.059	-0.061	-0.062
3	-0.058	-0.063	-0.068	-0.079	-0.085	-0.090	-0.087	-0.092	-0.096
4	-0.016	-0.018	-0.019	-0.026	-0.029	-0.031	-0.031	-0.034	-0.036
5	0.013	0.014	0.015	0.020	0.021	0.023	0.023	0.025	0.026
6	0.016	0.017	0.019	0.029	0.032	0.034	0.036	0.039	0.042
7	0.005	0.005	0.006	0.011	0.012	0.013	0.014	0.015	0.017
8	-0.00[illegible]	-0.005	-0.006	-0.009	-0.010	-0.011	-0.012	-0.013	-0.014
9	-0.006	-0.007	-0.007	-0.014	-0.015	-0.017	-0.019	-0.021	-0.023
10	-0.002	-0.002	-0.002	-0.005	-0.006	-0.007	-0.008	-0.009	-0.009
11	0.002	0.002	0.002	0.005	0.005	0.006	0.007	0.008	0.008
12	0.003	0.003	0.003	0.008	0.009	0.009	0.012	0.013	0.014

μ = 0.992

ν	λ=0.25 J=0.25	λ=0.25 J=0.50	λ=0.25 J=0.75	λ=0.50 J=0.25	λ=0.50 J=0.50	λ=0.50 J=0.75	λ=0.75 J=0.25	λ=0.75 J=0.50	λ=0.75 J=0.75
0	-0.340	-0.347	-0.353	-0.242	-0.245	-0.247	-0.189	-0.190	-0.191
1	0.144	0.153	0.162	0.142	0.148	0.152	0.132	0.135	0.137
2	-0.066	-0.070	-0.074	-0.068	-0.070	-0.073	-0.064	-0.067	-0.069
3	-0.080	-0.087	-0.094	-0.094	-0.100	-0.107	-0.097	-0.103	-0.108
4	-0.026	-0.028	-0.031	-0.033	-0.036	-0.039	-0.036	-0.039	-0.042
5	0.020	0.022	0.024	0.025	0.027	0.029	0.028	0.030	0.031
6	0.030	0.032	0.036	0.040	0.043	0.047	0.045	0.048	0.052
7	0.011	0.012	0.013	0.016	0.017	0.019	0.018	0.020	0.021
8	-0.010	-0.010	-0.012	-0.014	-0.015	-0.016	-0.016	-0.017	-0.018
9	-0.015	-0.017	-0.019	-0.023	-0.025	-0.027	-0.027	-0.029	-0.031
10	-0.006	-0.007	-0.007	-0.010	-0.010	-0.011	-0.011	-0.012	-0.013
11	0.006	0.006	0.007	0.009	0.009	0.010	0.010	0.011	0.012
12	0.009	0.010	0.011	0.015	0.016	0.018	0.018	0.019	0.021

TABLE 6.7

TWO-DIMENSIONAL GLAUERT COEFFICIENTS OF PROPELLER INDUCED CAMBER $\epsilon_{\Gamma',\nu}$

$\mu = 0.900$

	λ=0.25			λ=0.50			λ=0.75		
ν	J=0.25	J=0.50	J=0.75	J=0.25	J=0.50	J=0.75	J=0.25	J=0.50	J=0.75
0	-0.256	-0.261	-0.265	-0.193	-0.195	-0.196	-0.153	-0.154	-0.155
1	0.079	0.085	0.090	0.101	0.106	0.109	0.102	0.105	0.106
2	-0.033	-0.035	-0.037	-0.042	-0.044	-0.045	-0.044	-0.045	-0.047
3	-0.022	-0.025	-0.027	-0.046	-0.050	-0.053	-0.058	-0.062	-0.065
4	-0.003	-0.003	-0.004	-0.012	-0.013	-0.014	-0.018	-0.020	-0.021
5	0.004	0.004	0.005	0.010	0.011	0.011	0.014	0.015	0.016
6	0.002	0.003	0.003	0.010	0.012	0.013	0.018	0.020	0.021
7	0.000	0.000	0.000	0.003	0.003	0.003	0.006	0.006	0.007
8	-0.001	-0.001	-0.001	-0.003	-0.003	-0.004	-0.005	-0.006	-0.006
9	0.000	0.000	0.000	-0.003	-0.004	-0.004	-0.007	-0.008	-0.00[illegible]
10	0.000	0.000	0.000	-0.001	-0.001	-0.001	-0.002	-0.002	-0.003
11	0.000	0.000	0.000	0.001	0.001	0.001	0.002	0.003	0.003
12	0.000	0.000	0.000	0.001	0.001	0.001	0.003	0.003	0.004

$\mu = 0.940$

	λ=0.25			λ=0.50			λ=0.75		
ν	J=0.25	J=0.50	J=0.75	J=0.25	J=0.50	J=0.75	J=0.25	J=0.50	J=0.75
0	-0.289	-0.295	-0.300	-0.213	-0.216	-0.217	-0.168	-0.169	-0.170
1	0.102	0.110	0.117	0.118	0.123	0.127	0.114	0.117	0.119
2	-0.042	-0.046	-0.048	-0.051	-0.053	-0.055	-0.051	-0.053	-0.055
3	-0.037	-0.042	-0.045	-0.061	-0.067	-0.072	-0.072	-0.077	-0.081
4	-0.008	-0.009	-0.010	-0.018	-0.020	-0.022	-0.024	-0.027	-0.029
5	0.007	0.008	0.009	0.014	0.016	0.017	0.018	0.020	0.021
6	0.007	0.008	0.009	0.018	0.020	0.022	0.026	0.029	0.031
7	0.001	0.002	0.002	0.006	0.007	0.007	0.009	0.010	0.01[illegible]
8	-0.002	-0.002	-0.002	-0.005	-0.006	-0.007	-0.008	-0.009	-0.010
9	-0.002	-0.002	-0.002	-0.007	-0.008	-0.009	-0.012	-0.013	-0.015
10	0.000	0.000	0.000	-0.002	-0.003	-0.003	-0.004	-0.005	-0.006
11	0.001	0.001	0.001	0.002	0.003	0.003	0.004	0.005	0.005
12	0.001	0.001	0.001	0.003	0.004	0.004	0.006	0.007	0.008

$\mu = 0.970$

	λ=0.25			λ=0.50			λ=0.75		
ν	J=0.25	J=0.50	J=0.75	J=0.25	J=0.50	J=0.75	J=0.25	J=0.50	J=0.75
0	-0.316	-0.324	-0.330	-0.229	-0.232	-0.234	-0.180	-0.181	-0.182
1	0.123	0.133	0.141	0.130	0.136	0.141	0.124	0.127	0.129
2	-0.053	-0.057	-0.061	-0.059	-0.062	-0.065	-0.058	-0.060	-0.062
3	-0.055	-0.062	-0.068	-0.077	-0.084	-0.090	-0.085	-0.091	-0.096
4	-0.015	-0.017	-0.019	-0.025	-0.028	-0.031	-0.030	-0.033	-0.036
5	0.012	0.014	0.015	0.019	0.021	0.023	0.022	0.024	0.026
6	0.015	0.017	0.019	0.028	0.031	0.034	0.035	0.039	0.042
7	0.005	0.005	0.006	0.010	0.011	0.013	0.013	0.015	0.017
8	-0.004	-0.005	-0.006	-0.009	-0.010	-0.011	-0.011	-0.013	-0.014
9	-0.006	-0.007	-0.007	-0.013	-0.015	-0.017	-0.018	-0.021	-0.023
10	-0.002	-0.002	-0.002	-0.005	-0.006	-0.007	-0.007	-0.008	-0.009
11	0.002	0.002	0.003	0.005	0.005	0.006	0.007	0.008	0.008
12	0.003	0.003	0.003	0.007	0.008	0.009	0.011	0.013	0.014

$\mu = 0.994$

	λ=0.25			λ=0.50			λ=0.75		
ν	J=0.25	J=0.50	J=0.75	J=0.25	J=0.50	J=0.75	J=0.25	J=0.50	J=0.75
0	-0.339	-0.348	-0.355	-0.243	-0.246	-0.248	-0.190	-0.191	-0.192
1	0.141	0.153	0.163	0.141	0.148	0.153	0.131	0.135	0.137
2	-0.065	-0.071	-0.075	-0.067	-0.071	-0.074	-0.064	-0.067	-0.069
3	-0.078	-0.088	-0.096	-0.092	-0.100	-0.107	-0.096	-0.103	-0.108
4	-0.025	-0.029	-0.032	-0.032	-0.036	-0.040	-0.036	-0.039	-0.042
5	0.020	0.023	0.025	0.025	0.028	0.030	0.027	0.030	0.032
6	0.030	0.034	0.038	0.039	0.044	0.048	0.043	0.048	0.053
7	0.011	0.013	0.015	0.016	0.017	0.019	0.018	0.020	0.022
8	-0.010	-0.011	-0.013	-0.013	-0.015	-0.017	-0.015	-0.017	-0.019
9	-0.016	-0.018	-0.021	-0.023	-0.025	-0.028	-0.026	-0.029	-0.032
10	-0.007	-0.008	-0.008	-0.009	-0.011	-0.012	-0.011	-0.012	-0.014
11	0.006	0.006	0.008	0.009	0.010	0.011	0.010	0.011	0.012
12	0.010	0.011	0.013	0.015	0.017	0.019	0.018	0.020	0.022

N = 3
e = 0.994
χ = -0.25

N = 4
e = 0.994
χ = -0.25

TABLE 6.8

TWO-DIMENSIONAL GLAUERT COEFFICIENTS OF PROPELLER INDUCED CAMBER $\epsilon_{\Gamma,\nu}$

μ=0.900

ν	λ=0.25 J=0.25	λ=0.25 J=0.50	λ=0.25 J=0.75	λ=0.50 J=0.25	λ=0.50 J=0.50	λ=0.50 J=0.75	λ=0.75 J=0.25	λ=0.75 J=0.50	λ=0.75 J=0.75
0	-0.256	-0.261	-0.265	-0.193	-0.195	-0.196	-0.153	-0.154	-0.155
1	0.080	0.086	0.091	0.102	0.106	0.109	0.102	0.105	0.106
2	-0.033	-0.035	-0.037	-0.042	-0.044	-0.046	-0.044	-0.046	-0.047
3	-0.023	-0.025	-0.027	-0.047	-0.050	-0.054	-0.059	-0.063	-0.065
4	-0.003	-0.003	-0.004	-0.012	-0.013	-0.014	-0.018	-0.020	-0.022
5	0.004	0.004	0.005	0.010	0.011	0.011	0.014	0.015	0.016
6	0.003	0.003	0.003	0.011	0.012	0.013	0.018	0.020	0.021
7	0.000	0.000	0.000	0.003	0.003	0.003	0.006	0.006	0.007
8	-0.001	-0.001	-0.001	-0.003	-0.003	-0.004	-0.005	-0.006	-0.006
9	0.000	0.000	0.000	-0.003	-0.004	-0.004	-0.007	-0.008	-0.009
10	0.000	0.000	0.000	-0.001	-0.001	-0.001	-0.002	-0.002	-0.003
11	0.000	0.000	0.000	0.001	0.001	0.001	0.002	0.003	0.003
12	0.000	0.000	0.000	0.001	0.001	0.001	0.003	0.003	0.004

μ=0.940

ν	λ=0.25 J=0.25	λ=0.25 J=0.50	λ=0.25 J=0.75	λ=0.50 J=0.25	λ=0.50 J=0.50	λ=0.50 J=0.75	λ=0.75 J=0.25	λ=0.75 J=0.50	λ=0.75 J=0.75
0	-0.290	-0.296	-0.301	-0.213	-0.216	-0.218	-0.168	-0.169	-0.170
1	0.103	0.111	0.117	0.118	0.123	0.127	0.114	0.117	0.119
2	-0.043	-0.046	-0.048	-0.051	-0.053	-0.055	-0.052	-0.054	-0.055
3	-0.038	-0.042	-0.046	-0.062	-0.067	-0.072	-0.073	-0.077	-0.081
4	-0.008	-0.009	-0.010	-0.019	-0.021	-0.023	-0.025	-0.027	-0.029
5	0.007	0.008	0.009	0.014	0.016	0.017	0.018	0.020	0.021
6	0.007	0.008	0.009	0.019	0.021	0.023	0.026	0.029	0.031
7	0.001	0.002	0.002	0.006	0.007	0.007	0.009	0.011	0.012
8	-0.002	-0.002	-0.002	-0.006	-0.006	-0.007	-0.008	-0.009	-0.010
9	-0.002	-0.002	-0.002	-0.007	-0.008	-0.009	-0.012	-0.014	-0.015
10	0.000	0.000	0.000	-0.002	-0.003	-0.003	-0.005	-0.005	-0.006
11	0.001	0.001	0.001	0.002	0.003	0.003	0.004	0.005	0.005
12	0.001	0.001	0.001	0.003	0.004	0.004	0.006	0.007	0.008

μ=0.970

ν	λ=0.25 J=0.25	λ=0.25 J=0.50	λ=0.25 J=0.75	λ=0.50 J=0.25	λ=0.50 J=0.50	λ=0.50 J=0.75	λ=0.75 J=0.25	λ=0.75 J=0.50	λ=0.75 J=0.75
0	-0.317	-0.324	-0.330	-0.230	-0.232	-0.234	-0.180	-0.181	-0.182
1	0.124	0.134	0.142	0.131	0.137	0.141	0.124	0.127	0.129
2	-0.054	-0.058	-0.061	-0.059	0.062	-0.065	-0.059	-0.060	-0.062
3	-0.057	-0.063	-0.069	-0.078	-0.084	-0.090	-0.086	-0.091	-0.096
4	-0.016	-0.018	-0.020	-0.026	-0.029	-0.031	-0.031	-0.033	-0.036
5	0.013	0.014	0.015	0.019	0.021	0.023	0.023	0.025	0.026
6	0.015	0.017	0.019	0.028	0.031	0.034	0.035	0.039	0.042
7	0.005	0.005	0.006	0.010	0.012	0.013	0.014	0.015	0.01[illegible]
8	-0.005	-0.005	-0.006	-0.009	-0.010	-0.011	-0.012	-0.013	-0.014
9	-0.006	-0.007	-0.008	-0.014	-0.015	-0.017	-0.019	-0.021	-0.023
10	-0.002	-0.002	-0.002	-0.005	-0.006	-0.007	-0.008	-0.009	-0.009
11	0.002	0.002	0.003	0.005	0.005	0.006	0.007	0.008	0.008
12	0.003	0.003	0.003	0.008	0.009	0.010	0.011	0.013	0.014

μ=0.994

ν	λ=0.25 J=0.25	λ=0.25 J=0.50	λ=0.25 J=0.75	λ=0.50 J=0.25	λ=0.50 J=0.50	λ=0.50 J=0.75	λ=0.75 J=0.25	λ=0.75 J=0.50	λ=0.75 J=0.75
0	-0.340	-0.349	-0.355	-0.243	-0.246	-0.248	-0.190	-0.191	-0.192
1	0.143	0.154	0.164	0.142	0.148	0.153	0.132	0.135	0.138
2	-0.06[illegible]	-0.071	-0.075	-0.067	-0.071	-0.074	-0.064	-0.067	-0.069
3	-0.080	-0.089	-0.097	-0.093	-0.101	-0.108	-0.097	-0.103	-0.109
4	-0.026	-0.029	-0.032	-0.033	-0.037	-0.040	-0.036	-0.040	-0.042
5	0.020	0.023	0.025	0.025	0.028	0.030	0.028	0.030	0.032
6	0.030	0.035	0.038	0.040	0.044	0.048	0.044	0.048	0.053
7	0.012	0.013	0.015	0.016	0.018	0.020	0.018	0.020	0.022
8	-0.010	-0.011	-0.013	-0.014	-0.015	-0.017	-0.016	-0.017	-0.019
9	-0.016	-0.018	-0.021	-0.023	-0.026	-0.029	-0.027	-0.029	-0.032
10	-0.007	-0.008	-0.009	-0.010	-0.011	-0.012	-0.011	-0.013	-0.014
11	0.006	0.007	0.008	0.009	0.010	0.011	0.010	0.011	0.013
12	0.010	0.012	0.013	0.015	0.017	0.019	0.018	0.020	0.022

N=6
e = 0.994
χ = -0.25

TABLE 6.9

TWO-DIMENSIONAL GLAUERT COEFFICIENTS OF PROPELLER INDUCED CAMBER $\epsilon_{\Gamma,\nu}$

μ=0.900

	λ=0.25			λ=0.50			λ=0.75		
ν	J=0.25	J=0.50	J=0.75	J=0.25	J=0.50	J=0.75	J=0.25	J=0.50	J=0.75
0	-0.258	-0.262	-0.266	-0.193	-0.195	-0.197	-0.154	-0.154	-0.155
1	0.032	0.087	0.091	0.103	0.107	0.110	0.103	0.105	0.107
2	-0.034	-0.036	-0.037	-0.043	-0.044	-0.046	-0.045	-0.046	-0.047
3	-0.024	-0.026	-0.028	-0.048	-0.051	-0.054	-0.060	-0.063	-0.066
4	-0.003	-0.003	-0.004	-0.012	-0.014	-0.015	-0.019	-0.020	-0.022
5	0.004	0.004	0.005	0.010	0.011	0.012	0.014	0.015	0.016
6	0.003	0.003	0.003	0.011	0.012	0.013	0.019	0.020	0.022
7	0.000	0.000	0.000	0.003	0.003	0.003	0.006	0.007	0.007
8	-0.001	-0.001	-0.001	-0.003	-0.003	-0.004	-0.006	-0.006	-0.006
9	0.000	0.000	0.000	-0.003	-0.004	-0.604	-0.007	-0.008	-0.009
10	0.000	0.000	0.000	-0.001	-0.001	-0.001	-0.002	-0.003	-0.003
11	0.000	0.000	0.000	0.001	0.001	0.001	0.002	0.003	0.003
12	0.000	0.000	0.000	0.001	0.001	0.001	0.003	0.004	0.004

μ=0.940

	λ=0.25			λ=0.50			λ=0.75		
ν	J=0.25	J=0.50	J=0.75	J=0.25	J=0.50	J=0.75	J=0.25	J=0.50	J=0.75
0	-0.291	-0.297	-0.301	-0.214	-0.216	-0.218	-0.169	-0.170	-0.170
1	0.106	0.112	0.118	0.120	0.124	0.128	0.115	0.117	0.119
2	-0.044	-0.047	-0.049	-0.052	-0.054	-0.056	-0.052	-0.054	-0.055
3	-0.039	-0.043	-0.046	-0.064	-0.069	-0.073	-0.074	-0.078	-0.082
4	-0.008	-0.009	-0.010	-0.019	-0.021	-0.023	-0.025	-0.027	-0.029
5	0.008	0.008	0.009	0.015	0.016	0.017	0.019	0.020	0.021
6	0.007	0.008	0.009	0.019	0.021	0.023	0.027	0.030	0.032
7	0.001	0.002	0.002	0.006	0.007	0.007	0.010	0.011	0.012
8	-0.002	-0.002	-0.002	-0.006	-0.006	-0.007	-0.009	-0.009	-0.010
9	-0.002	-0.002	-0.002	-0.008	-0.008	-0.009	-0.013	-0.014	-0.015
10	0.000	0.000	0.000	-0.003	-0.003	-0.003	-0.005	-0.005	-0.006
11	0.001	0.001	0.001	0.003	0.003	0.003	0.004	0.005	0.005
12	0.001	0.001	0.001	0.004	0.004	0.004	0.007	0.007	0.008

μ=0.970

	λ=0.25			λ=0.50			λ=0.75		
ν	J=0.25	J=0.50	J=0.75	J=0.25	J=0.50	J=0.75	J=0.25	J=0.50	J=0.75
0	-0.319	-0.326	-0.331	-0.230	-0.233	-0.235	-0.180	-0.181	-0.182
1	0.127	0.136	0.143	0.133	0.138	0.142	0.125	0.127	0.129
2	-0.055	-0.058	-0.062	-0.060	-0.063	-0.065	-0.059	-0.061	-0.063
3	-0.059	-0.064	-0.070	-0.080	-0.086	-0.091	-0.087	-0.093	-0.097
4	-0.016	-0.018	-0.020	-0.027	-0.029	-0.032	-0.031	-0.034	-0.036
5	0.013	0.014	0.016	0.020	0.022	0.023	0.023	0.025	0.027
6	0.016	0.018	0.020	0.030	0.032	0.035	0.036	0.040	0.043
7	0.005	0.006	0.006	0.011	0.012	0.013	0.014	0.016	0.017
8	-0.005	-0.005	-0.006	-0.009	-0.010	-0.011	-0.012	-0.013	-0.014
9	-0.006	-0.007	-0.008	-0.014	-0.016	-0.017	-0.020	-0.021	-0.023
10	-0.002	-0.002	-0.002	-0.006	-0.006	-0.007	-0.008	-0.009	-0.010
11	0.002	0.002	0.003	0.005	0.006	0.006	0.007	0.008	0.009
12	0.003	0.003	0.003	0.008	0.009	0.010	0.012	0.013	0.014

μ=0.994

	λ=0.25			λ=0.50			λ=0.75		
ν	J=0.25	J=0.50	J=0.75	J=0.25	J=0.50	J=0.75	J=0.25	J=0.50	J=0.75
0	-0.343	-0.350	-0.356	-0.244	-0.246	-0.248	-0.190	-0.191	-0.192
1	0.146	0.156	0.165	0.144	0.149	0.154	0.133	0.136	0.138
2	-0.067	-0.072	-0.076	-0.068	-0.072	-0.074	-0.065	-0.067	-0.070
3	-0.083	-0.091	-0.098	-0.096	-0.103	-0.109	-0.099	-0.105	-0.110
4	-0.027	-0.030	-0.033	-0.034	-0.037	-0.040	-0.037	-0.040	-0.043
5	0.021	0.023	0.026	0.026	0.028	0.031	0.028	0.030	0.032
6	0.032	0.035	0.038	0.041	0.045	0.049	0.046	0.050	0.054
7	0.012	0.014	0.015	0.017	0.018	0.020	0.019	0.021	0.022
8	-0.011	-0.012	-0.013	-0.014	-0.016	-0.017	-0.016	-0.018	-0.019
9	-0.017	-0.019	-0.021	-0.024	-0.026	-0.029	-0.028	-0.030	-0.033
10	-0.007	-0.008	-0.009	-0.010	-0.011	-0.012	-0.012	-0.013	-0.014
11	0.006	0.007	0.008	0.009	0.010	0.011	0.011	0.012	0.013
12	0.011	0.012	0.013	0.016	0.017	0.019	0.019	0.021	0.023

N = 3
e = 0.990
χ = 0.00

TABLE 6.10

TWO-DIMENSIONAL GLAUERT COEFFICIENTS OF PROPELLER INDUCED CAMBER $\epsilon_{\Gamma',\nu}$

μ=0.900

ν	λ=0.25 J=0.25	λ=0.25 J=0.50	λ=0.25 J=0.75	λ=0.50 J=0.25	λ=0.50 J=0.50	λ=0.50 J=0.75	λ=0.75 J=0.25	λ=0.75 J=0.50	λ=0.75 J=0.75
0	-0.262	-0.267	-0.271	-0.194	-0.196	-0.197	-0.152	-0.152	-0.152
1	0	0	0	0	0	0	0	0	0
2	-0.059	-0.064	-0.068	-0.089	-0.094	-0.098	-0.097	-0.101	-0.104
3	0	0	0	0	0	0	0	0	0
4	0.013	0.014	0.016	0.031	0.034	0.036	0.041	0.044	0.047
5	0	0	0	0	0	0	0	0	0
6	-0.003	-0.003	-0.003	-0.012	-0.013	-0.015	-0.019	-0.021	-0.023
7	0	0	0	0	0	0	0	0	0
8	0.002	0.002	0.002	0.006	0.007	0.008	0.012	0.013	0.014
9	0	0	0	0	0	0	0	0	0
10	0.000	0.000	0.000	-0.002	-0.003	-0.003	-0.006	-0.006	-0.007
11	0	0	0	0	0	0	0	0	0
12	0.001	0.001	0.001	0.002	0.002	0.003	0.005	0.005	0.006

μ=0.940

ν	λ=0.25 J=0.25	λ=0.25 J=0.50	λ=0.25 J=0.75	λ=0.50 J=0.25	λ=0.50 J=0.50	λ=0.50 J=0.75	λ=0.75 J=0.25	λ=0.75 J=0.50	λ=0.75 J=0.75
0	-0.293	-0.300	-0.304	-0.214	-0.215	-0.216	-0.166	-0.166	-0.166
1	0	0	0	0	0	0	0	0	0
2	-0.082	-0.089	-0.096	-0.107	-0.114	-0.119	-0.113	-0.117	-0.121
3	0	0	0	0	0	0	0	0	0
4	0.023	0.026	0.029	0.042	0.047	0.050	0.052	0.056	0.059
5	0	0	0	0	0	0	0	0	0
6	-0.008	-0.009	-0.010	-0.019	-0.022	-0.024	-0.027	-0.030	-0.032
7	0	0	0	0	0	0	0	0	0
8	0.004	0.004	0.005	0.012	0.013	0.015	0.018	0.020	0.021
9	0	0	0	0	0	0	0	0	0
10	-0.001	-0.001	-0.001	-0.006	-0.007	-0.007	-0.010	-0.011	-0.012
11	0	0	0	0	0	0	0	0	0
12	0.001	0.001	0.002	0.005	0.005	0.006	0.008	0.009	0.010

μ=0.970

ν	λ=0.25 J=0.25	λ=0.25 J=0.50	λ=0.25 J=0.75	λ=0.50 J=0.25	λ=0.50 J=0.50	λ=0.50 J=0.75	λ=0.75 J=0.25	λ=0.75 J=0.50	λ=0.75 J=0.75
0	-0.319	-0.326	-0.331	-0.229	-0.230	-0.231	-0.177	-0.177	-0.177
1	0	0	0	0	0	0	0	0	0
2	-0.105	-0.115	-0.124	-0.121	-0.132	-0.138	-0.125	-0.131	-0.135
3	0	0	0	0	0	0	0	0	0
4	0.037	0.041	0.046	0.054	0.060	0.065	0.062	0.067	0.071
5	0	0	0	0	0	0	0	0	0
6	-0.016	-0.018	-0.020	-0.028	-0.032	-0.035	-0.035	-0.038	-0.041
7	0	0	0	0	0	0	0	0	0
8	0.010	0.011	0.012	0.019	0.021	0.023	0.024	0.027	0.030
9	0	0	0	0	0	0	0	0	0
10	-0.004	-0.005	-0.006	-0.011	-0.012	-0.014	-0.015	-0.017	-0.019
11	0	0	0	0	0	0	0	0	0
12	0.004	0.004	0.005	0.009	0.010	0.012	0.013	0.015	0.016

μ=0.990

ν	λ=0.25 J=0.25	λ=0.25 J=0.50	λ=0.25 J=0.75	λ=0.50 J=0.25	λ=0.50 J=0.50	λ=0.50 J=0.75	λ=0.75 J=0.25	λ=0.75 J=0.50	λ=0.75 J=0.75
0	-0.337	-0.344	-0.350	-0.239	-0.241	-0.242	-0.184	-0.184	-0.184
1	0	0	0	0	0	0	0	0	0
2	-0.124	-0.136	-0.147	-0.136	-0.145	-0.152	-0.134	-0.140	-0.145
3	0	0	0	0	0	0	0	0	0
4	0.051	0.057	0.063	0.064	0.071	0.077	0.070	0.076	0.080
5	0	0	0	0	0	0	0	0	0
6	-0.026	-0.030	-0.033	-0.036	-0.040	-0.044	-0.041	-0.045	-0.050
7	0	0	0	0	0	0	0	0	0
8	0.018	0.020	0.023	0.026	0.029	0.032	0.030	0.034	0.036
9	0	0	0	0	0	0	0	0	0
10	-0.011	-0.012	-0.014	-0.017	-0.019	-0.021	-0.020	-0.023	-0.026
11	0	0	0	0	0	0	0	0	0
12	0.009	0.010	0.012	0.015	0.017	0.018	0.018	0.020	0.021

N = 4
e = 0.990
χ = 0.00

TABLE 6.11

TWO-DIMENSIONAL GLAUERT COEFFICIENTS OF PROPELLER INDUCED CAMBER $\epsilon_{\Gamma, \nu}$

μ=0.900

	λ=0.25			λ=0.50			λ=0.75		
ν	J=0.25	J=0.50	J=0.75	J=0.25	J=0.50	J=0.75	J=0.25	J=0.50	J=0.75
0	-0.263	-0.267	-0.271	-0.195	-0.196	-0.197	-0.152	-0.152	-0.152
1	0	0	0	0	0	0	0	0	0
2	-0.060	-0.064	-0.069	-0.090	-0.094	-0.098	-0.098	-0.101	-0.104
3	0	0	0	0	0	0	0	0	0
4	0.013	0.015	0.016	0.032	0.034	0.037	0.042	0.044	0.047
5	0	0	0	0	0	0	0	0	0
6	-0.003	-0.003	-0.003	-0.012	-0.013	-0.015	-0.020	-0.021	-0.023
7	0	0	0	0	0	0	0	0	0
8	0.002	0.002	0.002	0.007	0.007	0.008	0.012	0.013	0.014
9	0	0	0	0	0	0	0	0	0
10	0.000	0.000	0.000	-0.002	-0.003	-0.003	-0.006	-0.006	-0.007
11	0	0	0	0	0	0	0	0	0
12	0.001	0.001	0.001	0.002	0.002	0.003	0.005	0.005	0.006

μ=0.940

	λ=0.25			λ=0.50			λ=0.75		
ν	J=0.25	J=0.50	J=0.75	J=0.25	J=0.50	J=0.75	J=0.25	J=0.50	J=0.75
0	-0.295	-0.300	-0.305	-0.214	-0.215	-0.216	-0.166	-0.166	-0.166
1	0	0	0	0	0	0	0	0	0
2	-0.083	-0.090	-0.096	-0.109	-0.115	-0.120	-0.113	-0.118	-0.121
3	0	0	0	0	0	0	0	0	0
4	0.024	0.027	0.029	0.043	0.047	0.050	0.053	0.056	0.060
5	0	0	0	0	0	0	0	0	0
6	-0.008	-0.009	-0.010	-0.020	-0.022	-0.024	-0.028	-0.030	-0.032
7	0	0	0	0	0	0	0	0	0
8	0.004	0.005	0.005	0.012	0.013	0.015	0.018	0.020	0.022
9	0	0	0	0	0	0	0	0	0
10	-0.001	-0.001	-0.001	-0.006	-0.007	-0.007	-0.010	-0.011	-0.013
11	0	0	0	0	0	0	0	0	0
12	0.001	0.001	0.002	0.005	0.005	0.006	0.008	0.009	0.010

μ=0.970

	λ=0.25			λ=0.50			λ=0.75		
ν	J=0.25	J=0.50	J=0.75	J=0.25	J=0.50	J=0.75	J=0.25	J=0.50	J=0.75
0	-0.320	-0.327	-0.332	-0.229	-0.230	-0.232	-0.177	-0.177	-0.177
1	0	0	0	0	0	0	0	0	0
2	-0.107	-0.116	-0.124	-0.125	-0.132	-0.138	-0.126	-0.131	-0.135
3	0	0	0	0	0	0	0	0	0
4	0.038	0.042	0.046	0.056	0.061	0.065	0.063	0.068	0.071
5	0	0	0	0	0	0	0	0	0
6	-0.017	-0.018	-0.020	-0.029	-0.032	-0.035	-0.035	-0.039	-0.042
7	0	0	0	0	0	0	0	0	0
8	0.010	0.011	0.012	0.019	0.021	0.024	0.025	0.027	0.030
9	0	0	0	0	0	0	0	0	0
10	-0.005	-0.005	-0.006	-0.011	-0.013	-0.014	-0.016	-0.017	-0.019
11	0	0	0	0	0	0	0	0	0
12	0.004	0.004	0.005	0.009	0.011	0.012	0.013	0.015	0.016

μ=0.990

	λ=0.25			λ=0.50			λ=0.75		
ν	J=0.25	J=0.50	J=0.75	J=0.25	J=0.50	J=0.75	J=0.25	J=0.50	J=0.75
0	-0.338	-0.345	-0.350	-0.239	-0.241	-0.242	-0.184	-0.184	-0.185
1	0	0	0	0	0	0	0	0	0
2	-0.126	-0.137	-0.147	-0.138	-0.146	-0.152	-0.135	-0.141	-0.146
3	0	0	0	0	0	0	0	0	0
4	0.052	0.058	0.063	0.066	0.072	0.077	0.071	0.075	0.080
5	0	0	0	0	0	0	0	0	0
6	-0.027	-0.030	-0.033	-0.037	-0.041	-0.045	-0.042	-0.046	-0.050
7	0	0	0	0	0	0	0	0	0
8	0.018	0.021	0.023	0.027	0.030	0.033	0.031	0.034	0.037
9	0	0	0	0	0	0	0	0	0
10	-0.011	-0.012	-0.014	-0.017	-0.019	-0.021	-0.021	-0.024	-0.026
11	0	0	0	0	0	0	0	0	0
12	0.010	0.011	0.012	0.015	0.017	0.019	0.018	0.020	0.022

N = 6
e = 0.990
χ = 0.00

TABLE 6.12

TWO-DIMENSIONAL GLAUERT COEFFICIENTS OF PROPELLER INDUCED CAMBER $c_{T,\nu}$

μ=0.900

	λ=0.25			λ=0.50			λ=0.75		
ν	J=0.25	J=0.50	J=0.75	J=0.25	J=0.50	J=0.75	J=0.25	J=0.50	J=0.75
0	-0.264	-0.268	-0.272	-0.195	-0.196	-0.197	-0.152	-0.152	-0.152
1	0	0	0	0	0	0	0	0	0
2	-0.062	-0.066	-0.069	0.091	-0.095	-0.099	-0.099	-0.102	-0.105
3	0	0	0	0	0	0	0	0	0
4	0.011	0.015	0.016	0.033	0.035	0.037	0.043	0.045	0.047
5	0	0	0	0	0	0	0	0	0
6	-0.003	-0.003	-0.004	-0.013	-0.014	-0.015	-0.020	-0.022	-0.023
7	0	0	0	0	0	0	0	0	0
8	0.002	0.002	0.002	0.007	0.007	0.008	0.012	0.013	0.014
9	0	0	0	0	0	0	0	0	0
10	0.000	0.000	0.000	-0.003	-0.003	-0.003	-0.006	-0.007	-0.007
11	0	0	0	0	0	0	0	0	0
12	0.001	0.001	0.001	0.002	0.002	0.003	0.005	0.005	0.006

μ=0.940

	λ=0.25			λ=0.50			λ=0.75		
ν	J=0.25	J=0.50	J=0.75	J=0.25	J=0.50	J=0.75	J=0.25	J=0.50	J=0.75
0	-0.296	-0.301	-0.306	-0.214	-0.216	-0.217	-0.166	-0.166	-0.166
1	0	0	0	0	0	0	0	0	0
2	-0.086	-0.092	-0.097	-0.111	-0.116	-0.121	-0.115	-0.118	-0.121
3	0	0	0	0	0	0	0	0	0
4	0.025	0.027	0.030	0.045	0.048	0.051	0.054	0.057	0.060
5	0	0	0	0	0	0	0	0	0
6	-0.008	-0.009	-0.010	-0.021	-0.023	-0.024	-0.028	-0.031	-0.033
7	0	0	0	0	0	0	0	0	0
8	0.004	0.005	0.005	0.013	0.014	0.015	0.019	0.020	0.022
9	0	0	0	0	0	0	0	0	0
10	-0.001	-0.001	-0.002	-0.006	-0.007	-0.008	-0.011	-0.012	-0.013
11	0	0	0	0	0	0	0	0	0
12	0.001	0.001	0.002	0.005	0.006	0.006	0.009	0.010	0.010

μ=0.970

	λ=0.25			λ=0.50			λ=0.75		
ν	J=0.25	J=0.50	J=0.75	J=0.25	J=0.50	J=0.75	J=0.25	J=0.50	J=0.75
0	-0.322	-0.328	-0.333	-0.229	-0.231	-0.232	-0.177	-0.177	-0.177
1	0	0	0	0	0	0	0	0	0
2	-0.110	-0.118	-0.126	-0.128	-0.134	-0.139	-0.128	-0.132	-0.136
3	0	0	0	0	0	0	0	0	0
4	0.040	0.043	0.047	0.057	0.062	0.066	0.065	0.069	0.072
5	0	0	0	0	0	0	0	0	0
6	-0.018	-0.019	-0.021	-0.030	-0.033	-0.035	-0.037	-0.039	-0.042
7	0	0	0	0	0	0	0	0	0
8	0.011	0.011	0.013	0.020	0.022	0.024	0.026	0.028	0.030
9	0	0	0	0	0	0	0	0	0
10	-0.005	-0.005	-0.006	-0.012	-0.013	-0.014	-0.016	-0.018	-0.019
11	0	0	0	0	0	0	0	0	0
12	0.004	0.005	0.005	0.010	0.011	0.012	0.014	0.015	0.017

μ=0.990

	λ=0.25			λ=0.50			λ=0.75		
ν	J=0.25	J=0.50	J=0.75	J=0.25	J=0.50	J=0.75	J=0.25	J=0.50	J=0.75
0	-0.340	-0.346	-0.351	-0.239	-0.241	-0.242	-0.184	-0.184	-0.185
1	0	0	0	0	0	0	0	0	0
2	-0.131	-0.140	-0.149	-0.140	-0.147	-0.154	-0.138	-0.142	-0.146
3	0	0	0	0	0	0	0	0	0
4	0.055	0.059	0.065	0.068	0.073	0.078	0.072	0.077	0.081
5	0	0	0	0	0	0	0	0	0
6	-0.029	-0.031	-0.034	-0.039	-0.042	-0.045	-0.044	-0.047	-0.051
7	0	0	0	0	0	0	0	0	0
8	0.020	0.021	0.023	0.028	0.030	0.033	0.032	0.034	0.037
9	0	0	0	0	0	0	0	0	0
10	-0.012	-0.013	-0.014	-0.018	-0.020	-0.022	-0.022	-0.024	-0.026
11	0	0	0	0	0	0	0	0	0
12	0.010	0.011	0.012	0.016	0.017	0.019	0.019	0.020	0.022

N=3
e = 0.992
χ = 0.00

TABLE 6.13

TWO-DIMENSIONAL GLAUERT COEFFICIENTS OF PROPELLER INDUCED CAMBER $\epsilon_{\Gamma,\nu}$

μ=0.900

ν	λ=0.25 J=0.25	λ=0.25 J=0.50	λ=0.25 J=0.75	λ=0.50 J=0.25	λ=0.50 J=0.50	λ=0.50 J=0.75	λ=0.75 J=0.25	λ=0.75 J=0.50	λ=0.75 J=0.75
0	-0.262	-0.267	-0.271	-0.195	-0.196	-0.197	-0.152	-0.152	-0.152
1	0	0	0	0	0	0	0	0	0
2	-0.059	-0.065	-0.069	-0.089	-0.094	-0.098	-0.098	-0.101	-0.104
3	0	0	0	0	0	0	0	0	0
4	0.013	0.015	0.016	0.031	0.034	0.037	-0.041	0.044	-0.047
5	0	0	0	0	0	0	0	0	0
6	-0.003	-0.003	-0.003	-0.012	-0.013	-0.015	-0.019	-0.021	-0.023
7	0	0	0	0	0	0	0	0	0
8	0.002	0.002	0.002	0.006	0.007	0.008	0.012	0.013	0.014
9	0	0	0	0	0	0	0	0	0
10	0.000	0.000	0.000	-0.002	-0.003	-0.003	-0.006	-0.006	-0.007
11	0	0	0	0	0	0	0	0	0
12	0.001	0.001	0.001	0.002	0.002	0.003	0.005	0.005	0.006

μ=0.940

ν	λ=0.25 J=0.25	λ=0.25 J=0.50	λ=0.25 J=0.75	λ=0.50 J=0.25	λ=0.50 J=0.50	λ=0.50 J=0.75	λ=0.75 J=0.25	λ=0.75 J=0.50	λ=0.75 J=0.75
0	-0.294	-0.300	-0.305	-0.214	-0.215	-0.216	-0.166	-0.166	-0.166
1	0	0	0	0	0	0	0	0	0
2	-0.082	-0.090	-0.097	-0.108	-0.115	-0.120	-0.113	-0.118	-0.121
3	0	0	0	0	0	0	0	0	0
4	0.024	0.027	0.029	0.043	0.047	0.051	0.052	0.056	0.060
5	0	0	0	0	0	0	0	0	0
6	-0.008	-0.009	-0.010	-0.020	-0.022	-0.024	-0.027	-0.030	-0.032
7	0	0	0	0	0	0	0	0	0
8	0.004	0.005	0.005	0.012	0.013	0.015	0.018	0.020	0.022
9	0	0	0	0	0	0	0	0	0
10	-0.001	-0.001	-0.002	-0.006	-0.007	-0.007	-0.010	-0.011	-0.013
11	0	0	0	0	0	0	0	0	0
12	0.001	0.001	0.002	0.005	0.005	0.006	0.008	0.009	0.010

μ=0.970

ν	λ=0.25 J=0.25	λ=0.25 J=0.50	λ=0.25 J=0.75	λ=0.50 J=0.25	λ=0.50 J=0.50	λ=0.50 J=0.75	λ=0.75 J=0.25	λ=0.75 J=0.50	λ=0.75 J=0.75
0	-0.319	-0.326	-0.332	-0.229	-0.230	-0.232	-0.177	-0.177	-0.177
1	0	0	0	0	0	0	0	0	0
2	-0.106	-0.116	-0.125	-0.124	-0.132	-0.139	-0.126	-0.131	-0.135
3	0	0	0	0	0	0	0	0	0
4	0.037	0.042	0.046	0.055	0.061	[illegible]	0.062	0.067	0.072
5	0	0	0	0	0	0	0	0	0
6	-0.016	-0.019	-0.021	-0.029	-0.032	-0.035	-0.035	-0.039	-0.042
7	0	0	0	0	0	0	0	0	0
8	0.010	0.011	0.012	0.019	0.022	0.024	0.025	0.028	0.030
9	0	0	0	0	0	0	0	0	0
10	-0.005	-0.005	-0.006	-0.011	-0.013	-0.014	-0.015	-0.017	-0.019
11	0	0	0	0	0	0	0	0	0
12	0.004	0.004	0.005	0.009	0.011	0.012	0.013	0.015	0.016

μ=0.992

ν	λ=0.25 J=0.25	λ=0.25 J=0.50	λ=0.25 J=0.75	λ=0.50 J=0.25	λ=0.50 J=0.50	λ=0.50 J=0.75	λ=0.75 J=0.25	λ=0.75 J=0.50	λ=0.75 J=0.75
0	-0.339	-0.347	-0.353	-0.240	-0.242	-0.243	-0.185	-0.185	-0.185
1	0	0	0	0	0	0	0	0	0
2	-0.127	-0.140	-0.151	-0.138	-0.147	-0.154	-0.136	-0.142	-0.147
3	0	0	0	0	0	0	0	0	0
4	0.053	0.060	0.066	0.066	0.073	0.079	0.071	0.076	0.081
5	0	0	0	0	0	0	0	0	0
6	-0.028	-0.032	-0.036	-0.037	-0.042	-0.046	-0.043	-0.047	-0.051
7	0	0	0	0	0	0	0	0	0
8	0.020	0.022	0.025	0.027	0.031	0.034	0.031	0.034	0.038
9	0	0	0	0	0	0	0	0	0
10	-0.012	-0.014	-0.015	-0.018	-0.020	-0.022	-0.022	-0.024	-0.027
11	0	0	0	0	0	0	0	0	0
12	0.010	0.012	0.013	0.016	0.018	0.020	0.018	0.020	0.023

N = 4
e = 0.992
χ = 0.00

TABLE 6.14

TWO-DIMENSIONAL GLAUERT COEFFICIENTS OF PROPELLER INDUCED CAMBER $\epsilon_{T',\nu}$

μ=0.900

	λ=0.25			λ=0.50			λ=0.75		
ν	J=0.25	J=0.50	J=0.75	J=0.25	J=0.50	J=0.75	J=0.25	J=0.50	J=0.75
0	-0.263	-0.268	-0.271	-0.195	-0.195	-0.197	-0.152	-0.152	-0.152
1	0	0	0	0	0	0	0	0	0
2	-0.060	-0.065	-0.069	-0.090	-0.090	-0.099	-0.098	-0.102	-0.104
3	0	0	0	0	0	0	0	0	0
4	0.013	0.015	0.016	0.032	0.032	0.037	0.042	0.045	0.047
5	0	0	0	0	0	0	0	0	0
6	-0.002	-0.003	-0.004	-0.012	-0.012	-0.015	-0.020	-0.022	-0.023
7	0	0	0	0	0	0	0	0	0
8	0.002	0.002	0.002	0.007	0.007	0.008	0.012	0.013	0.014
9	0	0	0	0	0	0	0	0	0
10	0.000	0.000	0.000	-0.003	-0.002	-0.003	-0.006	-0.007	-0.007
11	0	0	0	0	0	0	0	0	0
12	0.001	0.001	0.001	0.002	0.002	0.003	0.005	0.005	0.006

μ=0.940

	λ=0.25			λ=0.50			λ=0.75		
ν	J=0.25	J=0.50	J=0.75	J=0.25	J=0.50	J=0.75	J=0.25	J=0.50	J=0.75
0	-0.295	-0.301	-0.305	-0.214	-0.215	-0.216	-0.166	-0.166	-0.166
1	0	0	0	0	0	0	0	0	0
2	-0.084	-0.091	-0.097	-0.109	-0.116	-0.120	-0.114	-0.118	-0.121
3	0	0	0	0	0	0	0	0	0
4	0.024	0.027	0.030	0.044	0.047	0.051	0.053	0.056	0.060
5	0	0	0	0	0	0	0	0	0
6	-0.008	-0.009	-0.010	-0.020	-0.023	-0.024	-0.028	-0.031	-0.033
7	0	0	0	0	0	0	0	0	0
8	0.004	0.005	0.005	0.012	0.013	0.015	0.018	0.020	0.022
9	0	0	0	0	0	0	0	0	0
10	-0.001	-0.001	-0.002	-0.006	-0.007	-0.008	-0.010	-0.012	-0.013
11	0	0	0	0	0	0	0	0	0
12	0.001	0.001	0.002	0.005	0.005	0.006	0.009	0.009	0.010

μ=0.970

	λ=0.25			λ=0.50			λ=0.75		
ν	J=0.25	J=0.50	J=0.75	J=0.25	J=0.50	J=0.75	J=0.25	J=0.50	J=0.75
0	-0.320	-0.327	-0.332	-0.229	-0.230	-0.232	-0.177	-0.177	-0.177
1	0	0	0	0	0	0	0	0	0
2	-0.103	-0.117	-0.125	-0.126	-0.134	-0.139	-0.126	-0.132	-0.135
3	0	0	0	0	0	0	0	0	0
4	0.038	0.042	0.047	0.056	0.061	0.066	0.063	0.067	0.072
5	0	0	0	0	0	0	0	0	0
6	-0.017	-0.019	-0.021	-0.029	-0.033	-0.035	-0.036	-0.040	-0.042
7	0	0	0	0	0	0	0	0	0
8	0.010	0.011	0.013	0.020	0.021	0.024	0.025	0.027	0.030
9	0	0	0	0	0	0	0	0	0
10	-0.005	-0.006	-0.006	-0.011	-0.013	-0.014	-0.016	-0.018	-0.019
11	0	0	0	0	0	0	0	0	0
12	0.004	0.004	0.005	0.010	0.010	0.012	0.014	0.014	0.016

μ=0.992

	λ=0.25			λ=0.50			λ=0.75		
ν	J=0.25	J=0.50	J=0.75	J=0.25	J=0.50	J=0.75	J=0.25	J=0.50	J=0.75
0	-0.340	-0.347	-0.353	-0.240	-0.242	-0.243	-0.185	-0.185	-0.185
1	0	0	0	0	0	0	0	0	0
2	-0.130	-0.142	-0.152	-0.140	-0.148	-0.155	-0.137	-0.143	-0.147
3	0	0	0	0	0	0	0	0	0
4	0.054	0.060	0.066	0.067	0.073	0.079	0.072	0.077	0.081
5	0	0	0	0	0	0	0	0	0
6	-0.029	-0.033	-0.036	-0.039	-0.043	-0.047	-0.044	-0.048	-0.051
7	0	0	0	0	0	0	0	0	0
8	0.020	0.022	0.025	0.027	0.030	0.034	0.032	0.035	0.038
9	0	0	0	0	0	0	0	0	0
10	-0.013	-0.014	-0.016	-0.019	-0.021	-0.023	-0.022	-0.025	-0.027
11	0	0	0	0	0	0	0	0	0
12	0.010	0.012	0.013	0.016	0.017	0.019	0.019	0.021	0.023

N= 6
e = 0.992
χ = 0.00

TABLE 6.15

TWO-DIMENSIONAL GLAUERT COEFFICIENTS OF PROPELLER INDUCED CAMBER $\epsilon_{\Gamma,\nu}$

μ=0.900

ν	λ=0.25 J=0.25	λ=0.25 J=0.50	λ=0.25 J=0.75	λ=0.50 J=0.25	λ=0.50 J=0.50	λ=0.50 J=0.75	λ=0.75 J=0.25	λ=0.75 J=0.50	λ=0.75 J=0.75
0	-0.264	-0.269	-0.272	-0.195	-0.196	-0.197	-0.152	-0.152	-0.152
1	0	0	0	0	0	0	0	0	0
2	-0.062	-0.066	-0.070	-0.091	-0.096	-0.099	-0.099	-0.102	-0.105
3	0	0	0	0	0	0	0	0	0
4	0.014	0.015	0.016	0.033	0.035	0.037	0.043	0.045	0.047
5	0	0	0	0	0	0	0	0	0
6	-0.003	-0.003	-0.004	-0.013	-0.014	-0.015	-0.020	-0.022	-0.024
7	0	0	0	0	0	0	0	0	0
8	0.002	0.002	0.002	0.007	0.008	0.008	0.012	0.013	0.014
9	0	0	0	0	0	0	0	0	0
10	0.000	0.000	0.000	-0.003	-0.003	-0.003	-0.006	-0.007	-0.008
11	0	0	0	0	0	0	0	0	0
12	0.001	0.001	0.001	0.002	0.002	0.003	0.005	0.005	0.005

μ=0.940

ν	λ=0.25 J=0.25	λ=0.25 J=0.50	λ=0.25 J=0.75	λ=0.50 J=0.25	λ=0.50 J=0.50	λ=0.50 J=0.75	λ=0.75 J=0.25	λ=0.75 J=0.50	λ=0.75 J=0.75
0	-0.296	-0.302	-0.306	-0.214	-0.216	-0.217	-0.166	-0.166	-0.166
1	0	0	0	0	0	0	0	0	0
2	-0.086	-0.092	-0.098	-0.111	-0.116	-0.121	-0.115	-0.119	-0.122
3	0	0	0	0	0	0	0	0	0
4	0.025	0.028	0.030	0.045	0.048	0.051	0.054	0.058	0.061
5	0	0	0	0	0	0	0	0	0
6	-0.009	-0.009	-0.010	-0.021	-0.023	-0.025	-0.029	-0.031	-0.033
7	0	0	0	0	0	0	0	0	0
8	0.004	0.005	0.005	0.013	0.014	0.015	0.019	0.020	0.022
9	0	0	0	0	0	0	0	0	0
10	-0.001	-0.001	-0.002	-0.006	-0.007	-0.008	-0.011	-0.012	-0.013
11	0	0	0	0	0	0	0	0	0
12	0.001	0.001	0.002	0.005	0.006	0.006	0.009	0.010	0.010

μ=0.970

ν	λ=0.25 J=0.25	λ=0.25 J=0.50	λ=0.25 J=0.75	λ=0.50 J=0.25	λ=0.50 J=0.50	λ=0.50 J=0.75	λ=0.75 J=0.25	λ=0.75 J=0.50	λ=0.75 J=0.75
0	-0.322	-0.328	-0.333	-0.229	-0.231	-0.232	-0.177	-0.177	-0.177
1	0	0	0	0	0	0	0	0	0
2	-0.111	-0.119	-0.127	-0.128	-0.134	-0.140	-0.128	-0.132	-0.136
3	0	0	0	0	0	0	0	0	0
4	0.040	0.044	0.047	0.058	0.062	0.066	0.065	0.069	0.073
5	0	0	0	0	0	0	0	0	0
6	-0.013	-0.019	-0.021	-0.030	-0.033	-0.036	-0.037	-0.040	-0.043
7	0	0	0	0	0	0	0	0	0
8	0.011	0.012	0.013	0.021	0.022	0.024	0.026	0.028	0.031
9	0	0	0	0	0	0	0	0	0
10	-0.005	-0.006	-0.006	-0.012	-0.013	-0.014	-0.017	-0.018	-0.020
11	0	0	0	0	0	0	0	0	0
12	0.004	0.005	0.005	0.010	0.011	0.012	0.014	0.015	0.017

μ=0.992

ν	λ=0.25 J=0.25	λ=0.25 J=0.50	λ=0.25 J=0.75	λ=0.50 J=0.25	λ=0.50 J=0.50	λ=0.50 J=0.75	λ=0.75 J=0.25	λ=0.75 J=0.50	λ=0.75 J=0.75
0	-0.342	-0.349	-0.354	-0.241	-0.242	-0.243	-0.185	-0.185	-0.185
1	0	0	0	0	0	0	0	0	0
2	-0.134	-0.144	-0.153	-0.142	-0.149	-0.156	-0.139	-0.144	-0.148
3	0	0	0	0	0	0	0	0	0
4	0.057	0.062	0.068	0.070	0.075	0.080	0.073	0.078	0.082
5	0	0	0	0	0	0	0	0	0
6	-0.030	-0.033	-0.036	-0.040	-0.043	-0.047	-0.045	-0.049	-0.052
7	0	0	0	0	0	0	0	0	0
8	0.021	0.023	0.026	0.029	0.032	0.035	0.033	0.036	0.038
9	0	0	0	0	0	0	0	0	0
10	-0.013	-0.014	-0.016	-0.019	-0.021	-0.023	-0.023	-0.025	-0.028
11	0	0	0	0	0	0	0	0	0
12	0.011	0.012	0.014	0.017	0.019	0.020	0.019	0.021	0.023

N=3
e=0.994
χ=0.00

TABLE 6.16

TWO-DIMENSIONAL GLAUERT COEFFICIENTS OF PROPELLER INDUCED CAMBER $c_{\Gamma,\nu}$

μ=0.900

	λ=0.25			λ=0.50			λ=0.75		
ν	J=0.25	J=0.50	J=0.75	J=0.25	J=0.50	J=0.75	J=0.25	J=0.50	J=0.75
0	-0.262	-0.268	-0.272	-0.195	-0.196	-0.197	-0.152	-0.152	-0.152
1	0	0	0	0	0	0	0	0	0
2	-0.060	-0.065	-0.070	-0.090	-0.095	-0.099	-0.098	-0.102	-0.105
3	0	0	0	0	0	0	0	0	0
4	0.013	0.015	0.016	0.032	0.035	0.037	0.042	0.045	0.047
5	0	0	0	0	0	0	0	0	0
6	-0.003	-0.003	-0.004	-0.012	-0.014	-0.015	-0.020	-0.022	-0.023
7	0	0	0	0	0	0	0	0	0
8	0.002	0.002	0.002	0.007	0.007	0.008	0.012	0.013	0.014
9	0	0	0	0	0	0	0	0	0
10	0.000	0.000	0.000	-0.003	-0.003	-0.003	-0.006	-0.007	-0.007
11	0	0	0	0	0	0	0	0	0
12	0.001	0.001	0.001	0.002	0.002	0.003	0.005	0.005	0.006

μ=0.940

	λ=0.25			λ=0.50			λ=0.75		
ν	J=0.25	J=0.50	J=0.75	J=0.25	J=0.50	J=0.75	J=0.25	J=0.50	J=0.75
0	-0.294	-0.301	-0.305	-0.214	-0.215	-0.216	-0.166	-0.166	-0.166
1	0	0	0	0	0	0	0	0	0
2	-0.083	-0.091	-0.098	-0.108	-0.115	-0.120	-0.113	-0.118	-0.121
3	0	0	0	0	0	0	[illegible]	0	0
4	0.024	0.027	0.030	0.043	0.048	0.051	0.053	0.057	0.060
5	0	0	0	0	0	0	0	0	0
6	-0.008	-0.009	-0.010	-0.020	-0.022	-0.025	-0.027	-0.030	-0.033
7	0	0	0	0	0	0	0	0	0
8	0.004	0.005	0.005	0.012	0.014	0.015	0.018	0.020	0.022
9	0	0	0	0	0	0	0	0	0
10	-0.001	-0.001	-0.002	-0.006	-0.007	-0.008	-0.010	-0.012	-0.013
11	0	0	0	0	0	0	0	0	0
12	0.001	0.001	0.002	0.005	0.006	0.006	0.008	0.009	0.010

μ=0.970

	λ=0.25			λ=0.50			λ=0.75		
ν	J=0.25	J=0.50	J=0.75	J=0.25	J=0.50	J=0.75	J=0.25	J=0.50	J=0.75
0	-0.320	-0.327	-0.332	-0.229	-0.230	-0.232	-0.177	-0.177	-0.177
1	0	0	0	0	0	0	0	0	0
2	-0.107	-0.117	-0.126	-0.125	-0.133	-0.139	-0.126	-0.131	-0.135
3	0	0	0	0	0	0	0	0	0
4	0.033	0.043	0.047	0.056	0.061	0.066	0.063	0.068	0.072
5	0	0	0	0	0	0	0	0	0
6	-0.017	-0.019	-0.021	-0.029	-0.033	-0.036	-0.035	-0.039	-0.042
7	0	0	0	0	0	0	0	0	0
8	0.010	0.012	0.013	0.020	0.022	0.024	0.025	0.028	0.031
9	0	0	0	0	0	0	0	0	0
10	-0.005	-0.005	-0.006	-0.011	-0.013	-0.014	-0.016	-0.018	-0.020
11	0	0	0	0	0	0	0	0	0
12	0.004	0.005	0.005	0.010	0.011	0.012	0.013	0.015	0.017

μ=0.994

	λ=0.25			λ=0.50			λ=0.75		
ν	J=0.25	J=0.50	J=0.75	J=0.25	J=0.50	J=0.75	J=0.25	J=0.50	J=0.75
0	-0.341	-0.349	-0.355	-0.241	-0.243	-0.244	-0.186	-0.186	-0.186
1	0	0	0	0	0	0	0	0	0
2	-0.131	-0.144	-0.155	-0.140	-0.150	-0.157	-0.138	-0.143	-0.148
3	0	0	0	0	0	0	0	0	0
4	0.056	0.063	0.070	0.068	0.075	0.081	0.072	0.079	0.083
5	0	0	0	0	0	0	0	0	0
6	-0.030	-0.035	-0.039	-0.039	-0.045	-0.049	-0.044	-0.048	-0.053
7	0	0	0	0	0	0	0	0	0
8	0.022	0.025	0.028	0.029	0.032	0.035	0.032	0.037	0.039
9	0	0	0	0	0	0	0	0	0
10	-0.014	-0.015	-0.017	-0.019	-0.022	-0.025	-0.023	-0.025	-0.028
11	0	0	0	0	0	0	0	0	0
12	0.012	0.014	0.015	0.017	0.019	0.021	0.019	0.022	0.024

TABLE 6.17

TWO-DIMENSIONAL GLAUERT COEFFICIENTS OF PROPELLER INDUCED CAMBER $\epsilon_{\Gamma,\nu}$

μ=0.900

ν	λ=0.25 J=0.25	λ=0.25 J=0.50	λ=0.25 J=0.75	λ=0.50 J=0.25	λ=0.50 J=0.50	λ=0.50 J=0.75	λ=0.75 J=0.25	λ=0.75 J=0.50	λ=0.75 J=0.75
0	-0.263	-0.268	-0.272	-0.195	-0.196	-0.197	-0.152	-0.152	-0.152
1	0	0	0	0	0	0	0	0	0
2	-0.061	-0.066	-0.070	-0.090	-0.095	-0.099	-0.098	-0.102	-0.105
3	0	0	0	0	0	0	0	0	0
4	0.014	0.015	0.016	0.032	0.035	0.037	0.042	0.045	0.047
5	0	0	0	0	0	0	0	0	0
6	-0.003	-0.003	-0.004	-0.012	-0.014	-0.015	-0.020	-0.022	-0.023
7	0	0	0	0	0	0	0	0	0
8	0.002	0.002	0.002	0.007	0.007	0.008	0.012	0.013	0.014
9	0	0	0	0	0	0	0	0	0
10	0.000	0.000	0.000	-0.003	-0.003	-0.003	-0.006	-0.007	-0.007
11	0	0	0	0	0	0	0	0	0
12	0.001	0.001	0.001	0.002	0.002	0.003	0.005	0.005	0.006

μ=0.940

ν	λ=0.25 J=0.25	λ=0.25 J=0.50	λ=0.25 J=0.75	λ=0.50 J=0.25	λ=0.50 J=0.50	λ=0.50 J=0.75	λ=0.75 J=0.25	λ=0.75 J=0.50	λ=0.75 J=0.75
0	-0.295	-0.301	-0.306	-0.214	-0.215	-0.217	-0.166	-0.166	-0.166
1	0	0	0	0	0	0	0	0	0
2	-0.085	-0.092	-0.098	-0.110	-0.116	-0.121	-0.114	-0.118	-0.122
3	0	0	0	0	0	0	0	0	0
4	0.025	0.027	0.030	0.044	0.048	0.051	0.053	0.057	0.060
5	0	0	0	0	0	0	0	0	0
6	-0.008	-0.009	-0.010	-0.020	-0.023	-0.025	-0.028	-0.031	-0.033
7	0	0	0	0	0	0	0	0	0
8	0.004	0.005	0.005	0.012	0.014	0.015	0.018	0.020	0.022
9	0	0	0	0	0	0	0	0	0
10	-0.001	-0.001	-0.002	-0.006	-0.007	-0.008	-0.011	-0.012	-0.013
11	0	0	0	0	0	0	0	0	0
12	0.001	0.001	0.002	0.005	0.006	0.006	0.009	0.010	0.011

μ=0.970

ν	λ=0.25 J=0.25	λ=0.25 J=0.50	λ=0.25 J=0.75	λ=0.50 J=0.25	λ=0.50 J=0.50	λ=0.50 J=0.75	λ=0.75 J=0.25	λ=0.75 J=0.50	λ=0.75 J=0.75
0	-0.321	-0.328	-0.333	-0.229	-0.231	-0.232	-0.177	-0.177	-0.177
1	0	0	0	0	0	0	0	0	0
2	-0.109	-0.118	-0.127	-0.126	-0.134	-0.140	-0.127	-0.132	-0.136
3	0	0	0	0	0	0	0	0	0
4	0.039	0.043	0.048	0.057	0.062	0.066	0.064	0.068	0.072
5	0	0	0	0	0	0	0	0	0
6	-0.017	-0.019	-0.021	-0.030	-0.033	-0.036	-0.036	-0.039	-0.042
7	0	0	0	0	0	0	0	0	0
8	0.010	0.012	0.013	0.020	0.022	0.024	0.026	0.028	0.031
9	0	0	0	0	0	0	0	0	0
10	-0.005	-0.006	-0.006	-0.012	-0.013	-0.015	-0.016	-0.018	-0.020
11	0	0	0	0	0	0	0	0	0
12	0.004	0.005	0.005	0.010	0.011	0.012	0.014	0.015	0.017

μ=0.994

ν	λ=0.25 J=0.25	λ=0.25 J=0.50	λ=0.25 J=0.75	λ=0.50 J=0.25	λ=0.50 J=0.50	λ=0.50 J=0.75	λ=0.75 J=0.25	λ=0.75 J=0.50	λ=0.75 J=0.75
0	-0.342	-0.350	-0.356	-0.241	-0.243	-0.244	-0.186	-0.186	-0.186
1	0	0	0	0	0	0	0	0	0
2	-0.133	-0.145	-0.156	-0.141	-0.151	-0.158	-0.139	-0.144	-0.149
3	0	0	0	0	0	0	0	0	0
4	0.058	0.064	0.071	0.070	0.075	0.081	0.073	0.079	0.083
5	0	0	0	0	0	0	0	0	0
6	-0.031	-0.035	-0.039	-0.040	-0.045	-0.049	-0.045	-0.048	-0.053
7	0	0	0	0	0	0	0	0	0
8	0.022	0.025	0.028	0.030	0.032	0.036	0.033	0.037	0.039
9	0	0	0	0	0	0	0	0	0
10	-0.014	-0.016	-0.018	-0.019	-0.023	-0.025	-0.023	-0.025	-0.028
11	0	0	0	0	0	0	0	0	0
12	0.012	0.014	0.016	0.017	0.019	0.021	0.020	0.023	0.024

80

N=4
e=0.994
χ=0.00

N= 6
e = 0.994
χ = 0.00

TABLE 6.18

TWO-DIMENSIONAL GLAUERT COEFFICIENTS OF PROPELLER INDUCED CAMBER $\epsilon_{\Gamma,\nu}$

μ=0.900

	λ=0.25			λ=0.50			λ=0.75		
ν	J=0.25	J=0.50	J=0.75	J=0.25	J=0.50	J=0.75	J=0.25	J=0.50	J=0.75
0	-0.264	-0.269	-0.272	-0.195	-0.196	-0.197	-0.152	-0.152	-0.152
1	0	0	0	0	0	0	0	0	0
2	-0.063	-0.067	-0.071	-0.092	-0.096	-0.100	-0.099	-0.103	-0.105
3	0	0	0	0	0	0	0	0	0
4	0.014	0.015	0.017	0.033	0.035	0.038	0.043	0.046	0.048
5	0	0	0	0	0	0	0	0	0
6	-0.003	-0.003	-0.004	-0.013	-0.014	-0.015	-0.021	-0.022	-0.024
7	0	0	0	0	0	0	0	0	0
8	0.002	0.002	0.002	0.007	0.008	0.008	0.012	0.013	0.014
9	0	0	0	0	0	0	0	0	0
10	0.000	0.000	0.000	-0.003	-0.003	-0.003	-0.006	-0.007	-0.007
11	0	0	0	0	0	0	0	0	0
12	0.000	0.001	0.001	0.002	0.003	0.003	0.005	0.005	0.006

μ=0.940

	λ=0.25			λ=0.50			λ=0.75		
ν	J=0.25	J=0.50	J=0.75	J=0.25	J=0.50	J=0.75	J=0.25	J=0.50	J=0.75
0	-0.297	-0.302	-0.306	-0.214	-0.216	-0.217	-0.166	-0.166	-0.166
1	0	0	0	0	0	0	0	0	0
2	-0.087	-0.093	-0.099	-0.111	-0.117	-0.122	-0.115	-0.119	-0.123
3	0	0	0	0	0	0	0	0	0
4	0.026	0.028	0.031	0.045	0.049	0.052	0.055	0.058	0.061
5	0	0	0	0	0	0	0	0	0
6	-0.009	-0.010	-0.011	-0.021	-0.023	-0.025	-0.029	-0.031	-0.034
7	0	0	0	0	0	0	0	0	0
8	0.005	0.005	0.005	0.013	0.014	0.015	0.019	0.021	0.022
9	0	0	0	0	0	0	0	0	0
10	-0.001	-0.001	-0.002	-0.007	-0.007	-0.008	-0.011	-0.012	-0.014
11	0	0	0	0	0	0	0	0	0
12	0.001	0.002	0.002	0.005	0.006	0.006	0.009	0.010	0.011

μ=0.970

	λ=0.25			λ=0.50			λ=0.75		
ν	J=0.25	J=0.50	J=0.75	J=0.25	J=0.50	J=0.75	J=0.25	J=0.50	J=0.75
0	-0.323	-0.329	-0.334	-0.229	-0.231	-0.232	-0.177	-0.177	-0.177
1	0	0	0	0	0	0	0	0	0
2	-0.112	-0.120	-0.128	-0.128	-0.135	-0.141	-0.128	-0.133	-0.136
3	0	0	0	0	0	0	0	0	0
4	0.041	0.044	0.048	0.058	0.063	0.067	0.065	0.069	0.073
5	0	0	0	0	0	0	0	0	0
6	-0.018	-0.020	-0.022	-0.031	-0.034	-0.036	-0.037	-0.040	-0.043
7	0	0	0	0	0	0	0	0	0
8	0.011	0.012	0.013	0.021	0.023	0.025	0.027	0.029	0.031
9	0	0	0	0	0	0	0	0	0
10	-0.005	-0.006	-0.006	-0.012	-0.014	-0.015	-0.017	-0.018	-0.020
11	0	0	0	0	0	0	0	0	0
12	0.004	0.005	0.005	0.010	0.011	0.012	0.014	0.016	0.017

μ=0.994

	λ=0.25			λ=0.50			λ=0.75		
ν	J=0.25	J=0.50	J=0.75	J=0.25	J=0.50	J=0.75	J=0.25	J=0.50	J=0.75
0	-0.344	-0.351	-0.356	-0.242	-0.243	-0.244	-0.186	-0.186	-0.186
1	0	0	0	0	0	0	0	0	0
2	-0.138	-0.148	-0.159	-0.145	-0.152	-0.159	-0.140	-0.145	-0.149
3	0	0	0	0	0	0	0	0	0
4	0.060	0.066	0.071	0.071	0.077	0.082	0.075	0.080	0.084
5	0	0	0	0	0	0	0	0	0
6	-0.033	-0.036	-0.040	-0.042	-0.046	-0.050	-0.046	-0.049	-0.054
7	0	0	0	0	0	0	0	0	0
8	0.023	0.026	0.028	0.030	0.033	0.036	0.034	0.038	0.040
9	0	0	0	0	0	0	0	0	0
10	-0.015	-0.016	-0.019	-0.021	-0.023	-0.025	-0.024	-0.026	-0.029
11	0	0	0	0	0	0	0	0	0
12	0.012	0.014	0.015	0.018	0.019	0.021	0.020	0.023	0.024

TABLES 7.1 - 7.3

ELEMENTS FOR CURVATURE CORRECTION OF TWO-DIMENSIONAL GLAUERT COEFFICIENTS OF EFFECTIVE SHROUD CAMBER DISTRIBUTION $O_{k,\ell}$

See Ref. 5, Section 1.3 and identify $O_{k,\ell}$ as the elements of the matrix $[I + P + P^2 + P^3 + \dots]$. These elements have been taken directly from Tables 1.1 - 1.3 .

Accuracy: ± 0.0001

$\lambda = 0.25$

TABLE 7.1

ELEMENTS FOR CURVATURE CORRECTION OF TWO-DIMENSIONAL GLAUERT COEFFICIENTS OF EFFECTIVE SHROUD CAMBER DISTRIBUTION $O_{k,\ell}$

k \ ℓ	0	1	2	3	4	5	6
0	1.0277	0	0.0139	0	0.0000	0	0.0000
1	0.0568	1.0308	0.0008	-0.0031	0.0000	0.0000	0.0000
2	0.0063	0	1.0041	0	-0.0010	0	0.0000
3	-0.0001	-0.0010	0.0000	1.0015	0.0000	-0.0005	0.0000
4	0.0000	0	-0.0005	0	1.0008	0	-0.0003
5	0.0000	0.0000	0.0000	-0.0003	0.0000	1.0005	0.0000
6	0.0000	0	0.0000	0	-0.0002	0	1.0003

$\lambda = 0.50$

TABLE 7.2

ELEMENTS FOR CURVATURE CORRECTION OF TWO-DIMENSIONAL GLAUERT COEFFICIENTS OF EFFECTIVE SHROUD CAMBER DISTRIBUTION $O_{k,\ell}$

k \ ℓ	0	1	2	3	4	5	6
0	1.0796	0	0.0400	0	-0.0002	0	0.0000
1	0.1719	1.0933	0.0064	-0.0138	0.0000	0.0001	0.0000
2	0.0274	0	1.0179	0	-0.0042	0	0.0000
3	-0.0009	-0.0046	0.0000	1.0062	0.0000	-0.0020	0.0000
4	-0.0002	0	-0.0021	0	1.0032	0	-0.0012
5	0.0000	0.0000	0.0000	-0.0012	0.0000	1.0020	0.0000
6	0.0000	0	0.0000	0	-0.0008	0	1.0013

TABLE 7.3

ELEMENTS FOR CURVATURE CORRECTION OF TWO-DIMENSIONAL GLAUERT COEFFICIENTS OF EFFECTIVE SHROUD CAMBER DISTRIBUTION $O_{k,\ell}$

k \ ℓ	0	1	2	3	4	5	6
0	1.1398	0	0.0704	0	-0.0005	0	0.0000
1	0.3186	1.1722	0.0197	-0.0329	-0.0001	0.0004	0.0000
2	0.0650	0	1.0425	0	-0.0101	0	0.0001
3	-0.0022	-0.0110	-0.0001	1.0147	0.0000	-0.0047	0.0000
4	-0.0008	0	-0.0051	0	1.0074	0	-0.0028
5	0.0000	0.0001	0.0000	-0.0028	0.0000	1.0045	0.0000
6	0.0000	0	0.0000	0	-0.0018	0	1.0031

TABLES 8.1 - 8.27

ν^{TH} TERM OF PROPELLER-SHROUD THICKNESS CONTRIBUTION TO SHROUD THRUST COEFFICIENT $C_{\Gamma' t_\nu}$ FOR $C_T = 1$ AND $a_\nu = 1$

$$C_{\Gamma' t_0} = \frac{1}{2\sqrt{\lambda}} \int_0^{\pi} c_{\Gamma'}(\phi) \sqrt{1+\cos\phi}\; d\phi$$

$$C_{\Gamma' t_\nu} = \frac{(-\lambda)^{\nu-1}}{2} \int_0^{\pi} c_{\Gamma'}(\phi)\, (\cos\phi)^{\nu-1} \sin\phi\; d\phi \quad , \quad \nu = 1, 2, \ldots 6$$

See coversheet of TABLES 11.1 - 11.18 for $c_{\Gamma'}(x/c)$ where $x/c \equiv -\frac{1}{2}\cos\phi$.

Accuracy: ± 0.001

TABLE 8.1

ν^{TH} TERM OF PROPELLER-SHROUD THICKNESS CONTRIBUTION TO SHROUD THRUST COEFFICIENT $C_{T'{t_\nu}}$

μ=0.900

	λ=0.25			λ=0.50			λ=0.75		
ν	J=0.25	J=0.50	J=0.75	J=0.25	J=0.50	J=0.75	J=0.25	J=0.50	J=0.75
0	0.027	0.027	0.026	-0.000	-0.002	-0.004	-0.011	-0.012	-0.014
1	0.057	0.060	0.062	0.054	0.055	0.056	0.045	0.046	0.046
2	0.010	0.010	0.010	0.019	0.020	0.020	0.026	0.026	0.027
3	0.001	0.001	0.001	0.001	0.001	0.000	-0.001	-0.001	-0.001
4	0.000	0.000	0.000	0.003	0.003	0.003	0.009	0.009	0.010
5	0.000	0.000	0.000	0.000	0.000	0.000	-0.001	-0.001	-0.001
6	0.000	0.000	0.000	0.000	0.000	0.000	0.004	0.004	0.004

μ=0.940

	λ=0.25			λ=0.50			λ=0.75		
ν	J=0.25	J=0.50	J=0.75	J=0.25	J=0.50	J=0.75	J=0.25	J=0.50	J=0.75
0	0.021	0.020	0.018	-0.007	-0.010	-0.012	-0.015	-0.018	-0.020
1	0.068	0.072	0.075	0.061	0.062	0.063	0.050	0.051	0.051
2	0.012	0.012	0.013	0.022	0.023	0.024	0.029	0.030	0.031
3	0.001	0.001	0.001	0.000	0.000	0.000	-0.001	-0.002	-0.002
4	0.000	0.001	0.001	0.003	0.004	0.004	0.011	0.011	0.011
5	0.000	0.000	0.000	0.000	0.000	0.000	-0.001	-0.002	-0.002
6	0.000	0.000	0.000	0.001	0.001	0.001	0.004	0.004	0.004

μ=0.970

	λ=0.25			λ=0.50			λ=0.75		
ν	J=0.25	J=0.50	J=0.75	J=0.25	J=0.50	J=0.75	J=0.25	J=0.50	J=0.75
0	0.011	0.008	0.005	-0.013	-0.017	-0.020	-0.020	-0.023	-0.025
1	0.078	0.082	0.086	0.066	0.068	0.069	0.054	0.054	0.055
2	0.014	0.015	0.015	0.025	0.026	0.027	0.032	0.033	0.034
3	0.001	0.000	0.000	0.000	0.000	0.000	-0.002	-0.003	-0.003
4	0.001	0.001	0.001	0.004	0.004	0.004	0.012	0.012	0.012
5	0.000	0.000	0.000	0.000	0.000	0.000	-0.002	-0.002	-0.002
6	0.000	0.000	0.000	0.001	0.001	0.001	0.005	0.005	0.005

N=4
e = 0.990
χ = -0.25

TABLE 8.2

ν^{TH} TERM OF PROPELLER-SHROUD THICKNESS CONTRIBUTION TO SHROUD THRUST COEFFICIENT $C_{I\,t_\nu}$

μ=0.900

	λ=0.25			λ=0.50			λ=0.75		
ν	J=0.25	J=0.50	J=0.75	J=0.25	J=0.50	J=0.75	J=0.25	J=0.50	J=0.75
0	0.027	0.026	0.026	-0.001	-0.003	-0.004	-0.011	-0.013	-0.014
1	0.058	0.060	0.062	0.054	0.055	0.056	0.046	0.046	0.046
2	0.010	0.010	0.011	0.019	0.020	0.020	0.026	0.026	0.027
3	0.001	0.001	0.001	0.001	0.001	0.000	-0.001	-0.001	-0.001
4	0.000	0.000	0.000	0.003	0.003	0.003	0.009	0.009	0.010
5	0.000	0.000	0.000	0.000	0.000	0.000	-0.001	-0.001	-0.001
6	0.000	0.000	0.000	0.000	0.000	0.000	0.004	0.004	0.004

μ=0.940

	λ=0.25			λ=0.50			λ=0.75		
ν	J=0.25	J=0.50	J=0.75	J=0.25	J=0.50	J=0.75	J=0.25	J=0.50	J=0.75
0	0.021	0.020	0.018	-0.007	-0.010	-0.012	-0.016	-0.018	-0.020
1	0.069	0.072	0.075	.061	0.062	0.063	0.050	0.051	0.051
2	0.012	0.012	0.013	0.022	0.023	0.024	0.029	0.030	0.031
3	0.001	0.001	0.001	0.000	0.000	0.000	-0.002	-0.002	-0.002
4	0.000	0.001	0.001	0.003	0.004	0.004	0.011	0.011	0.011
5	0.000	0.000	0.000	0.000	0.000	0.000	-0.002	-0.002	-0.002
6	0.000	0.000	0.000	0.001	0.001	0.001	0.004	0.004	0.004

μ=0.970

	λ=0.25			λ=0.50			λ=0.75		
ν	J=0.25	J=0.50	J=0.75	J=0.25	J=0.50	J=0.75	J=0.25	J=0.50	J=0.75
0	0.010	0.008	0.005	-0.014	-0.017	-0.021	-0.020	-0.023	-0.025
1	0.079	0.083	0.086	0.066	0.068	0.069	0.054	0.054	0.055
2	0.014	0.015	0.015	0.025	0.026	0.027	0.032	0.033	0.034
3	0.000	0.000	0.000	0.000	0.000	0.000	-0.002	-0.003	-0.003
4	0.001	0.001	0.001	0.004	0.004	0.004	0.012	0.012	0.012
5	0.000	0.000	0.000	0.000	0.000	0.000	-0.002	-0.002	-0.002
6	0.000	0.000	0.000	0.001	0.001	0.001	0.005	0.005	0.005

N=6
e=0.990
χ=-0.25

TABLE 8.3

ν^{TH} TERM OF PROPELLER-SHROUD THICKNESS CONTRIBUTION TO SHROUD THRUST COEFFICIENT C_{T',t_ν}

μ=0.900

	λ=0.25			λ=0.50			λ=0.75		
ν	J=0.25	J=0.50	J=0.75	J=0.25	J=0.50	J=0.75	J=0.25	J=0.50	J=0.75
0	0.026	0.026	0.026	-0.001	-0.003	-0.005	-0.012	-0.013	-0.014
1	0.058	0.061	0.063	0.054	0.056	0.057	0.046	0.046	0.046
2	0.010	0.010	0.011	0.019	0.020	0.020	0.026	0.027	0.027
3	0.001	0.001	0.001	0.001	0.000	0.000	-0.001	-0.001	-0.001
4	0.000	0.000	0.000	0.003	0.003	0.003	0.009	0.010	0.010
5	0.000	0.000	0.000	0.000	0.000	0.000	-0.001	-0.001	-0.001
6	0.000	0.000	0.000	0.000	0.000	0.000	0.004	0.004	0.004

μ=0.940

	λ=0.25			λ=0.50			λ=0.75		
ν	J=0.25	J=0.50	J=0.75	J=0.25	J=0.50	J=0.75	J=0.25	J=0.50	J=0.75
0	0.020	0.019	0.018	-0.008	-0.011	-0.013	-0.017	-0.018	-0.020
1	0.070	0.073	0.076	0.061	0.063	0.064	0.050	0.051	0.051
2	0.012	0.013	0.013	0.023	0.023	0.024	0.030	0.030	0.031
3	0.001	0.001	0.001	0.001	0.000	0.000	-0.002	-0.002	-0.002
4	0.001	0.001	0.001	0.004	0.004	0.004	0.011	0.011	0.011
5	0.000	0.000	0.000	0.000	0.000	0.000	-0.002	-0.002	-0.002
6	0.000	0.000	0.000	0.001	0.001	0.001	0.004	0.004	0.004

μ=0.970

	λ=0.25			λ=0.50			λ=0.75		
ν	J=0.25	J=0.50	J=0.75	J=0.25	J=0.50	J=0.75	J=0.25	J=0.50	J=0.75
0	0.009	0.007	0.004	-0.015	-0.018	-0.021	-0.021	-0.023	-0.025
1	0.080	0.084	0.087	0.067	0.068	0.069	0.054	0.055	0.055
2	0.014	0.015	0.016	0.025	0.026	0.027	0.033	0.033	0.034
3	0.000	0.000	0.000	0.000	0.000	0.000	-0.003	-0.003	-0.004
4	0.001	0.001	0.001	0.004	0.004	0.004	0.012	0.012	0.012
5	0.000	0.000	0.000	0.000	0.000	0.000	-0.002	-0.002	-0.002
6	0.000	0.000	0.000	0.001	0.001	0.001	0.005	0.005	0.005

N= 3
e =0.992
χ=-0.25

TABLE 8.4

ν^{TH} TERM OF PROPELLER-SHROUD THICKNESS CONTRIBUTION TO SHROUD THRUST COEFFICIENT $C_{T'_{t_\nu}}$

μ=0.900

	λ=0.25			λ=0.50			λ=0.75		
ν	J=0.25	J=0.50	J=0.75	J=0.25	J=0.50	J=0.75	J=0.25	J=0.50	J=0.75
0	0.027	0.026	0.026	-0.001	-0.003	-0.004	-0.011	-0.013	-0.011
1	0.057	0.060	0.063	0.054	0.055	0.056	0.045	0.046	0.046
2	0.010	0.010	0.011	0.019	0.020	0.020	0.026	0.026	0.027
3	0.001	0.001	0.001	0.001	0.001	0.000	-0.001	-0.001	-0.001
4	0.000	0.000	0.000	0.003	0.003	0.003	0.009	0.009	0.010
5	0.000	0.000	0.000	0.000	0.000	0.000	-0.001	-0.001	-0.001
6	0.000	0.000	0.000	0.000	0.000	0.000	0.004	0.004	0.004

μ=0.940

	λ=0.25			λ=0.50			λ=0.75		
ν	J=0.25	J=0.50	J=0.75	J=0.25	J=0.50	J=0.75	J=0.25	J=0.50	J=0.75
0	0.021	0.019	0.018	-0.007	-0.010	-0.013	-0.016	-0.018	-0.020
1	0.069	0.072	0.075	0.061	0.062	0.064	0.050	0.051	0.051
2	0.012	0.012	0.013	0.022	0.023	0.024	0.029	0.030	0.031
3	0.001	0.001	0.001	0.000	0.000	0.000	-0.001	-0.002	-0.002
4	0.000	0.001	0.001	0.003	0.004	0.004	0.011	0.011	0.011
5	0.000	0.000	0.000	0.000	0.000	0.000	-0.001	-0.002	-0.002
6	0.000	0.000	0.000	0.001	0.001	0.001	0.004	0.004	0.004

μ=0.970

	λ=0.25			λ=0.50			λ=0.75		
ν	J=0.25	J=0.50	J=0.75	J=0.25	J=0.50	J=0.75	J=0.25	J=0.50	J=0.75
0	0.010	0.007	0.004	-0.014	-0.017	-0.021	-0.020	-0.023	-0.025
1	0.078	0.083	0.086	0.066	0.068	0.069	0.054	0.054	0.055
2	0.014	0.015	0.015	0.025	0.026	0.027	0.032	0.033	0.034
3	0.000	0.000	0.000	0.000	0.000	0.000	-0.002	-0.003	-0.003
4	0.001	0.001	0.001	0.004	0.004	0.004	0.012	0.012	0.012
5	0.000	0.000	0.000	0.000	0.000	0.000	-0.002	-0.002	-0.002
6	0.000	0.000	0.000	0.001	0.001	0.001	0.005	0.005	0.005

N = 4
e = 0.992
χ = -0.25

TABLE 8.5

ν^{TH} TERM OF PROPELLER-SHROUD THICKNESS CONTRIBUTION TO SHROUD THRUST COEFFICIENT C_{T',t_ν}

μ=0.900

	λ=0.25			λ=0.50			λ=0.75		
ν	J=0.25	J=0.50	J=0.75	J=0.25	J=0.50	J=0.75	J=0.25	J=0.50	J=0.75
0	0.026	0.027	0.026	-0.001	-0.001	-0.004	-0.011	-0.011	-0.014
1	0.058	0.058	0.063	0.054	0.054	0.056	0.046	0.046	0.046
2	0.010	0.010	0.011	0.019	0.019	0.020	0.026	0.026	0.027
3	0.001	0.001	0.001	0.001	0.001	0.000	-0.001	-0.001	-0.001
4	0.000	0.000	0.000	0.003	0.003	0.003	0.009	0.009	0.010
5	0.000	0.000	0.000	0.000	0.000	0.000	-0.001	-0.001	-0.001
6	0.000	0.000	0.000	0.000	0.000	0.000	0.004	0.004	0.004

μ=0.940

	λ=0.25			λ=0.50			λ=0.75		
ν	J=0.25	J=0.50	J=0.75	J=0.25	J=0.50	J=0.75	J=0.25	J=0.50	J=0.75
0	0.020	0.019	0.018	-0.008	-0.010	-0.013	-0.016	-0.018	-0.020
1	0.069	0.073	0.076	0.061	0.062	0.064	0.050	0.051	0.051
2	0.012	0.013	0.013	0.022	0.023	0.024	0.029	0.030	0.031
3	0.001	0.001	0.001	0.000	0.000	0.000	-0.002	-0.002	-0.002
4	0.000	0.001	0.001	0.003	0.004	0.004	0.011	0.011	0.011
5	0.000	0.000	0.000	0.000	0.000	0.000	-0.002	-0.002	-0.002
6	0.000	0.000	0.000	0.001	0.001	0.001	0.004	0.004	0.004

μ=0.970

	λ=0.25			λ=0.50			λ=0.75		
ν	J=0.25	J=0.50	J=0.75	J=0.25	J=0.50	J=0.75	J=0.25	J=0.50	J=0.75
0	0.010	0.007	0.004	-0.014	-0.018	-0.021	-0.020	-0.023	-0.025
1	0.079	0.033	0.087	0.066	0.068	0.069	0.054	0.054	0.055
2	0.014	0.015	0.016	0.025	0.026	0.027	0.032	0.033	0.034
3	0.000	0.000	0.000	0.000	0.000	0.000	-0.002	-0.003	-0.003
4	0.001	0.001	0.001	0.004	0.004	0.004	0.012	0.012	0.012
5	0.000	0.000	0.000	0.000	0.000	0.000	-0.002	-0.002	-0.002
6	0.000	0.000	0.000	0.001	0.001	0.001	0.005	0.005	0.005

N=6
e=0.992
χ=-0.25

TABLE 8.6

ν^{TH} TERM OF PROPELLER-SHROUD THICKNESS CONTRIBUTION TO SHROUD THRUST COEFFICIENT $C_{T'{t_\nu}}$

μ=0.900

ν	λ=0.25 J=0.25	λ=0.25 J=0.50	λ=0.25 J=0.75	λ=0.50 J=0.25	λ=0.50 J=0.50	λ=0.50 J=0.75	λ=0.75 J=0.25	λ=0.75 J=0.50	λ=0.75 J=0.75
0	0.026	0.026	0.026	-0.002	-0.003	-0.005	-0.012	-0.013	-0.014
1	0.059	0.061	0.063	0.055	0.056	0.057	0.046	0.046	0.046
2	0.010	0.010	0.011	0.019	0.020	0.020	0.026	0.027	0.027
3	0.001	0.001	0.001	0.001	0.000	0.000	-0.001	-0.001	-0.001
4	0.000	0.000	0.000	0.003	0.003	0.003	0.009	0.010	0.010
5	0.000	0.000	0.000	0.000	0.000	0.000	-0.001	-0.001	-0.001
6	0.000	0.000	0.000	0.000	0.000	0.000	0.004	0.004	0.004

μ=0.940

ν	λ=0.25 J=0.25	λ=0.25 J=0.50	λ=0.25 J=0.75	λ=0.50 J=0.25	λ=0.50 J=0.50	λ=0.50 J=0.75	λ=0.75 J=0.25	λ=0.75 J=0.50	λ=0.75 J=0.75
0	0.020	0.019	0.017	-0.009	-0.011	-0.013	-0.017	-0.019	-0.020
1	0.070	0.073	0.076	0.061	0.063	0.064	0.050	0.051	0.051
2	0.012	0.013	0.013	0.023	0.023	0.024	0.030	0.030	0.031
3	0.001	0.001	0.001	-0.001	0.000	0.000	-0.002	-0.002	-0.002
4	0.001	0.001	0.001	0.004	0.004	0.004	0.011	0.011	0.011
5	0.000	0.000	0.000	0.000	0.000	0.000	-0.002	-0.002	-0.002
6	0.000	0.000	0.000	0.001	0.001	0.001	0.004	0.004	0.004

μ=0.970

ν	λ=0.25 J=0.25	λ=0.25 J=0.50	λ=0.25 J=0.75	λ=0.50 J=0.25	λ=0.50 J=0.50	λ=0.50 J=0.75	λ=0.75 J=0.25	λ=0.75 J=0.50	λ=0.75 J=0.75
0	0.008	0.006	0.003	-0.016	-0.019	-0.022	-0.021	-0.024	-0.026
1	0.080	0.084	0.087	0.067	0.068	0.069	0.054	0.055	0.055
2	0.014	0.015	0.016	0.025	0.026	0.027	0.033	0.033	0.034
3	0.000	0.000	0.000	0.000	0.000	0.000	-0.003	-0.003	-0.004
4	0.001	0.001	0.001	0.004	0.004	0.004	0.012	0.012	0.012
5	0.000	0.000	0.000	0.000	0.000	0.000	-0.002	-0.002	-0.002
6	0.000	0.000	0.000	0.001	0.001	0.001	0.005	0.005	0.005

N=3
e = 0.994
χ = -0.25

TABLE 8.7

ν^{TH} TERM OF PROPELLER-SHROUD THICKNESS CONTRIBUTION TO SHROUD THRUST COEFFICIENT $C_{T'_{t_\nu}}$

μ=0.900

ν	λ=0.25 J=0.25	λ=0.25 J=0.50	λ=0.25 J=0.75	λ=0.50 J=0.25	λ=0.50 J=0.50	λ=0.50 J=0.75	λ=0.75 J=0.25	λ=0.75 J=0.50	λ=0.75 J=0.75
0	0.026	0.026	0.026	-0.001	-0.003	-0.005	-0.011	-0.013	-0.014
1	0.057	0.061	0.063	0.054	0.055	0.056	0.045	0.046	0.046
2	0.010	0.010	0.011	0.019	0.020	0.020	0.026	0.026	0.027
3	0.001	0.001	0.001	0.001	0.001	0.000	-0.001	-0.001	-0.001
4	0.000	0.000	0.000	0.003	0.003	0.003	0.009	0.009	0.010
5	0.000	0.000	0.000	0.000	0.000	0.000	-0.001	-0.001	-0.001
6	0.000	0.000	0.000	0.000	0.000	0.000	0.004	0.004	0.004

μ=0.940

ν	λ=0.25 J=0.25	λ=0.25 J=0.50	λ=0.25 J=0.75	λ=0.50 J=0.25	λ=0.50 J=0.50	λ=0.50 J=0.75	λ=0.75 J=0.25	λ=0.75 J=0.50	λ=0.75 J=0.75
0	0.020	0.019	0.017	-0.007	-0.010	-0.013	-0.016	-0.018	-0.020
1	0.069	0.073	0.076	0.061	0.062	0.064	0.050	0.051	0.051
2	0.012	0.013	0.013	0.022	0.023	0.024	0.029	0.030	0.031
3	0.001	0.001	0.001	0.000	0.000	0.000	-0.001	-0.002	-0.002
4	0.000	0.001	0.001	0.003	0.004	0.004	0.011	0.011	0.011
5	0.000	0.000	0.000	0.000	0.000	0.000	-0.001	-0.002	-0.002
6	0.000	0.000	0.000	0.001	0.001	0.001	0.004	0.004	0.004

μ=0.970

ν	λ=0.25 J=0.25	λ=0.25 J=0.50	λ=0.25 J=0.75	λ=0.50 J=0.25	λ=0.50 J=0.50	λ=0.50 J=0.75	λ=0.75 J=0.25	λ=0.75 J=0.50	λ=0.75 J=0.75
0	0.010	0.007	0.003	-0.014	-0.018	-0.021	-0.020	-0.023	-0.025
1	0.079	0.083	0.087	0.066	0.068	0.069	0.054	0.054	0.055
2	0.014	0.015	0.016	0.025	0.026	0.027	0.032	0.033	0.034
3	0.000	0.000	0.000	0.000	0.000	0.000	-0.002	-0.003	-0.004
4	0.001	0.001	0.001	0.004	0.004	0.004	0.012	0.012	0.012
5	0.000	0.000	0.000	0.000	0.000	0.000	-0.002	-0.002	-0.002
6	0.000	0.000	0.000	0.001	0.001	0.001	0.005	0.005	0.005

N=4
e=0.994
χ=-0.25

TABLE 6.8

ν^{TH} TERM OF PROPELLER-SHROUD THICKNESS CONTRIBUTION TO SHROUD THRUST COEFFICIENT $C_{T'{t_\nu}}$

μ=0.900

ν	λ=0.25 J=0.25	λ=0.25 J=0.50	λ=0.25 J=0.75	λ=0.50 J=0.25	λ=0.50 J=0.50	λ=0.50 J=0.75	λ=0.75 J=0.25	λ=0.75 J=0.50	λ=0.75 J=0.75
0	0.026	0.026	0.026	-0.001	-0.003	-0.005	-0.011	-0.013	-0.014
1	0.058	0.061	0.063	0.054	0.056	0.057	0.046	0.046	0.046
2	0.010	0.010	0.011	0.019	0.020	0.020	0.026	-0.027	-0.027
3	0.001	0.001	0.001	0.001	0.000	0.000	-0.001	-0.001	-0.001
4	0.000	0.000	0.000	0.003	0.003	0.003	0.009	0.009	0.010
5	0.000	0.000	0.000	0.000	0.000	0.000	-0.001	-0.001	-0.001
6	0.000	0.000	0.000	0.000	0.000	0.000	0.004	0.004	0.004

μ=0.940

ν	λ=0.25 J=0.25	λ=0.25 J=0.50	λ=0.25 J=0.75	λ=0.50 J=0.25	λ=0.50 J=0.50	λ=0.50 J=0.75	λ=0.75 J=0.25	λ=0.75 J=0.50	λ=0.75 J=0.75
0	0.020	0.019	0.017	-0.008	-0.011	-0.013	-0.016	-0.018	-0.020
1	0.069	0.073	0.076	0.061	0.063	0.064	0.050	0.051	0.051
2	0.012	0.013	0.013	0.022	0.023	0.024	0.030	0.030	0.031
3	0.001	0.001	0.001	0.000	0.000	0.000	-0.002	-0.002	-0.002
4	0.001	0.001	0.001	0.003	0.004	0.004	0.011	0.011	0.011
5	0.000	0.000	0.000	0.000	0.000	0.000	-0.002	-0.002	-0.002
6	0.000	0.000	0.000	0.001	0.001	0.001	0.004	0.004	0.004

μ=0.970

ν	λ=0.25 J=0.25	λ=0.25 J=0.50	λ=0.25 J=0.75	λ=0.50 J=0.25	λ=0.50 J=0.50	λ=0.50 J=0.75	λ=0.75 J=0.25	λ=0.75 J=0.50	λ=0.75 J=0.75
0	0.009	0.006	0.003	-0.015	-0.018	-0.022	-0.021	-0.023	-0.025
1	0.079	0.084	0.067	0.066	0.068	0.069	0.054	0.054	0.055
2	0.014	0.015	0.016	0.025	0.026	0.027	0.033	0.033	0.034
3	0.000	0.000	0.000	0.000	0.000	0.000	-0.002	-0.003	-0.004
4	0.001	0.001	0.001	0.004	0.004	0.004	0.012	0.012	0.012
5	0.000	0.000	0.000	0.000	0.000	0.000	-0.002	-0.002	-0.002
6	0.000	0.000	0.000	0.001	0.001	0.001	0.005	0.005	0.005

N=6
e=0.994
χ=-0.25

TABLE 8.9

ν^{TH} TERM OF PROPELLER-SHROUD THICKNESS CONTRIBUTION TO SHROUD THRUST COEFFICIENT C_{T',t_ν}

μ=0.900

	λ=0.25			λ=0.50			λ=0.75		
ν	J=0.25	J=0.50	J=0.75	J=0.25	J=0.50	J=0.75	J=0.25	J=0.50	J=0.75
0	0.026	0.026	0.026	-0.002	-0.003	-0.005	-0.012	-0.013	-0.015
1	0.059	0.061	0.063	0.055	0.056	0.057	0.046	0.046	0.047
2	0.010	0.010	0.011	0.020	0.020	0.021	0.026	0.027	0.027
3	0.001	0.001	0.001	0.001	0.000	0.000	-0.001	-0.001	-0.001
4	0.000	0.000	0.000	0.003	0.003	0.003	0.009	0.010	0.010
5	0.000	0.000	0.000	0.000	0.000	0.000	-0.001	-0.001	-0.001
6	0 000	0.000	0.000	0.000	0.000	0.000	0.004	0.004	0.004

μ=0.940

	λ=0.25			λ=0.50			λ=0.75		
ν	J=0.25	J=0.50	J=0.75	J=0.25	J=0.50	J=0.75	J=0.25	J=0.50	J=0.75
0	0.019	0.018	0.017	-0.009	-0.011	-0.014	-0.017	-0.019	-0.021
1	0.071	0.074	0.076	0.061	0.063	0.064	0.050	0.051	0.051
2	0.012	0.013	0.013	0.023	0.023	0.024	0.030	0.030	0.031
3	0.001	0.001	0.001	-0.001	0.000	0.000	-0.002	-0.002	-0.002
4	0.001	0.001	0.001	0.004	0.004	0.004	0.011	0.011	0.011
5	0.000	0.000	0.000	0.000	0.000	0.000	-0.002	-0.002	-0.002
6	0.000	0.000	0.000	0.001	0.001	0.001	0.004	0.004	0.004

μ=0.970

	λ=0.25			λ=0.50			λ=0.75		
ν	J=0.25	J=0.50	J=0.75	J=0.25	J=0.50	J=0.75	J=0.25	J=0.50	J=0.75
0	0.008	0.005	0.003	-0.016	-0.019	-0.022	-0.021	-0.024	-0.026
1	0.081	0.084	0.088	0.067	0.068	0.070	0.054	0.055	0.055
2	0.014	0.015	0.016	0.025	0.026	0.027	0.033	0.034	0.034
3	0.000	0.000	0.000	0.000	0.000	-0.001	-0.003	-0.003	-0.004
4	0.001	0.001	0.001	0.004	0.004	0.004	0.012	0.012	0.012
5	0.000	0.000	0.000	0.000	0.000	0.000	-0.002	-0.002	-0.002
6	0.000	0.000	0.000	0.001	0.001	0.001	0.005	0.005	0.005

N=3
e=0.990
χ=0.00

S5

TABLE 8.10

ν^{TH} TERM OF PROPELLER-SHROUD THICKNESS CONTRIBUTION TO SHROUD THRUST COEFFICIENT $C_{\Gamma' t_\nu}$

μ=0.900

	λ=0.25			λ=0.50			λ=0.75		
ν	J=0.25	J=0.50	J=0.75	J=0.25	J=0.50	J=0.75	J=0.25	J=0.50	J=0.75
0	-0.128	-0.135	-0.141	-0.093	-0.096	-0.098	-0.067	-0.068	-0.069
1	0	0	0	0	0	0	0	0	0
2	0.013	0.013	0.014	0.028	0.029	0.030	0.039	0.040	0.041
3	0	0	0	0	0	0	0	0	0
4	0.000	0.001	0.001	0.004	0.004	0.004	0.011	0.011	0.011
5	0	0	0	0	0	0	0	0	0
6	0.000	0.000	0.000	0.001	0.001	0.001	0.004	0.004	0.004

μ=0.940

	λ=0.25			λ=0.50			λ=0.75		
ν	J=0.25	J=0.50	J=0.75	J=0.25	J=0.50	J=0.75	J=0.25	J=0.50	J=0.75
0	-0.157	-0.167	-0.175	-0.106	-0.109	-0.112	-0.075	-0.077	-0.078
1	0	0	0	0	0	0	0	0	0
2	0.016	0.017	0.018	0.033	0.034	0.035	0.045	0.046	0.047
3	0	0	0	0	0	0	0	0	0
4	0.001	0.001	0.001	0.004	0.004	0.004	0.012	0.012	0.012
5	0	0	0	0	0	0	0	0	0
6	0.000	0.000	0.000	0.001	0.001	0.001	0.004	0.004	0.004

μ=0.970

	λ=0.25			λ=0.50			λ=0.75		
ν	J=0.25	J=0.50	J=0.75	J=0.25	J=0.50	J=0.75	J=0.25	J=0.50	J=0.75
0	-0.183	-0.195	-0.205	-0.117	-0.121	-0.124	-0.081	-0.083	-0.084
1	0	0	0	0	0	0	0	0	0
2	0.019	0.021	0.022	0.037	0.038	0.040	0.049	0.051	0.052
3	0	0	0	0	0	[illegible]	0	0	0
4	0.001	0.001	0.001	0.004	0.005	0.005	0.013	0.013	0.013
5	0	0	0	0	0	0	0	0	0
6	0.000	0.000	0.000	0.001	0.001	0.001	0.005	0.005	0.005

N=4
e=0.990
χ=0.00

TABLE 8.11

ν^{TH} TERM OF PROPELLER-SHROUD THICKNESS CONTRIBUTION TO SHROUD THRUST COEFFICIENT $C_{T'_{t_\nu}}$

μ=0.900

	λ=0.25			λ=0.50			λ=0.75		
ν	J=0.25	J=0.50	J=0.75	J=0.25	J=0.50	J=0.75	J=0.25	J=0.50	J=0.75
0	-0.129	-0.136	-0.142	-0.093	-0.096	-0.098	-0.067	-0.068	-0.069
1	0	0	0	0	0	0	0	0	0
2	0.013	0.014	0.014	0.028	0.029	0.030	0.039	0.040	0.041
3	0	0	0	0	0	0	0	0	0
4	0.001	0.001	0.001	0.004	0.004	0.004	0.011	0.011	0.011
5	0	0	0	0	0	0	0	0	0
6	0.000	0.000	0.000	0.001	0.001	0.001	0.004	0.004	0.004

μ=0.940

	λ=0.25			λ=0.50			λ=0.75		
ν	J=0.25	J=0.50	J=0.75	J=0.25	J=0.50	J=0.75	J=0.25	J=0.50	J=0.75
0	-0.159	-0.168	-0.175	-0.106	-0.110	-0.112	-0.075	-0.077	-0.078
1	0	0	0	0	0	0	0	0	0
2	0.016	0.017	0.018	0.033	0.034	0.035	0.045	0.046	0.047
3	0	0	0	0	0	0	0	0	0
4	0.001	0.001	0.001	0.004	0.004	0.004	0.012	0.012	0.012
5	0	0	0	0	0	0	0	0	0
6	0.000	0.000	0.000	0.001	0.001	0.001	0.004	0.004	0.004

μ=0.970

	λ=0.25			λ=0.50			λ=0.75		
ν	J=0.25	J=0.50	J=0.75	J=0.25	J=0.50	J=0.75	J=0.25	J=0.50	J=0.75
0	-0.185	-0.196	-0.205	-0.117	-0.121	-0.124	-0.082	-0.083	-0.084
1	0	0	0	0	0	0	0	0	0
2	0.019	0.021	0.022	0.037	0.039	0.040	0.049	0.051	0.052
3	0	0	0	0	0	0	0	0	0
4	0.001	0.001	0.001	0.005	0.005	0.005	0.013	0.013	0.013
5	0	0	0	0	0	0	0	0	0
6	0.000	0.000	0.000	0.001	0.001	0.001	0.005	0.005	0.005

N = 6
e = 0.990
$\chi = 0.00$

S7

TABLE 8.12

ν^{TH} TERM OF PROPELLER-SHROUD THICKNESS CONTRIBUTION TO SHROUD THRUST COEFFICIENT $C_{\Gamma' t_\nu}$

$\mu = 0.900$

	λ=0.25			λ=0.50			λ=0.75		
ν	J=0.25	J=0.50	J=0.75	J=0.25	J=0.50	J=0.75	J=0.25	J=0.50	J=0.75
0	-0.132	-0.138	-0.143	-0.094	-0.096	-0.098	-0.068	-0.069	-0.069
1	0	0	0	0	0	0	0	0	0
2	0.013	0.014	0.014	0.029	0.029	0.030	0.040	0.041	0.041
3	0	0	0	0	0	0	0	0	0
4	0.001	0.001	0.001	0.004	0.004	0.004	0.011	0.011	0.011
5	0	0	0	0	0	0	0	0	0
6	0.000	0.000	0.000	0.001	0.001	0.001	0.004	0.004	0.004

$\mu = 0.940$

	λ=0.25			λ=0.50			λ=0.75		
ν	J=0.25	J=0.50	J=0.75	J=0.25	J=0.50	J=0.75	J=0.25	J=0.50	J=0.75
0	-0.162	-0.170	-0.177	-0.107	-0.110	-0.113	-0.076	-0.077	-0.078
1	0	0	0	0	0	0	0	0	0
2	0.017	0.017	0.018	0.033	0.034	0.035	0.045	0.046	0.047
3	0	0	0	0	0	0	0	0	0
4	0.001	0.001	0.001	0.004	0.004	0.004	0.012	0.012	0.012
5	0	0	0	0	0	0	0	0	0
6	0.000	0.000	0.000	0.001	0.001	0.001	0.004	0.004	0.004

$\mu = 0.970$

	λ=0.25			λ=0.50			λ=0.75		
ν	J=0.25	J=0.50	J=0.75	J=0.25	J=0.50	J=0.75	J=0.25	J=0.50	J=0.75
0	-0.189	-0.198	-0.207	-0.118	-0.122	-0.125	-0.082	-0.083	-0.084
1	0	0	0	0	0	0	0	0	0
2	0.020	0.021	0.022	0.037	0.039	0.040	0.049	0.051	0.052
3	0	0	0	0	0	0	0	0	0
4	0.001	0.001	0.001	0.005	0.005	0.005	0.013	0.013	0.013
5	0	0	0	0	0	0	0	0	0
6	0.000	0.000	0.000	0.001	0.001	0.001	0.005	0.005	0.005

N=3
e=0.992
x=0.00

TABLE 8.13

ν^{TH} TERM OF PROPELLER-SHROUD THICKNESS CONTRIBUTION TO SHROUD THRUST COEFFICIENT $C_{T'{t_\nu}}$

μ=0.900

	λ=0.25			λ=0.50			λ=0.75		
ν	J=0.25	J=0.50	J=0.75	J=0.25	J=0.50	J=0.75	J=0.25	J=0.50	J=0.75
0	-0.138	-0.136	-0.142	-0.093	-0.096	-0.098	-0.067	-0.068	-0.069
1	0	0	0	0	0	0	0	0	0
2	0.013	0.014	0.014	0.028	0.029	0.030	0.039	0.040	0.041
3	0	0	0	0	0	0	0	0	0
4	0.000	0.001	0.001	0.004	0.004	0.004	0.011	0.011	0.011
5	0	0	0	0	0	0	0	0	0
6	0.000	0.000	0.000	0.001	0.001	0.001	0.004	0.004	0.004

μ=0.940

	λ=0.25			λ=0.50			λ=0.75		
ν	J=0.25	J=0.50	J=0.75	J=0.25	J=0.50	J=0.75	J=0.25	J=0.50	J=0.75
0	-0.158	-0.168	-0.176	-0.106	-0.110	-0.112	-0.075	-0.077	-0.078
1	0	0	0	0	0	0	0	0	0
2	0.016	0.017	0.018	0.033	0.034	0.035	0.045	0.046	0.047
3	0	0	0	0	0	0	0	0	0
4	0.001	0.001	0.001	0.004	0.004	0.004	0.012	0.012	0.012
5	0	0	0	0	0	0	0	0	0
6	0.000	0.000	0.000	0.001	0.001	0.001	0.004	0.004	0.004

μ=0.970

	λ=0.25			λ=0.50			λ=0.75		
ν	J=0.25	J=0.50	J=0.75	J=0.25	J=0.50	J=0.75	J=0.25	J=0.50	J=0.75
0	-0.184	-0.196	-0.206	-0.117	-0.121	-0.124	-0.081	-0.083	-0.084
1	0	0	0	0	0	0	0	0	0
2	0.019	0.021	0.022	0.037	0.039	0.040	0.049	0.051	0.052
3	0	0	0	0	0	0	0	0	0
4	0.001	0.001	0.001	0.004	0.005	0.005	0.013	0.013	0.013
5	0	0	0	0	0	0	0	0	0
6	0.000	0.000	0.000	0.001	0.001	0.001	0.005	0.005	0.005

N=4
e =0.992
χ =0.00

TABLE 8.14

ν^{TH} TERM OF PROPELLER-SHROUD THICKNESS CONTRIBUTION TO SHROUD THRUST COEFFICIENT C_{T',t_ν}

μ=0.900

	λ=0.25			λ=0.50			λ=0.75		
ν	J=0.25	J=0.50	J=0.75	J=0.25	J=0.50	J=0.75	J=0.25	J=0.50	J=0.75
0	-0.130	-0.129	-0.142	-0.093	-0.093	-0.098	-0.067	-0.067	-0.069
1	0	0	0	0	0	0	0	0	0
2	0.013	0.013	0.014	0.028	0.028	0.030	0.040	0.039	0.041
3	0	0	0	0	0	0	0	0	0
4	0.001	0.001	0.001	0.004	0.004	0.004	0.011	0.011	0.011
5	0	0	0	0	0	0	0	0	0
6	0.000	0.000	0.000	0.001	0.001	0.001	0.004	0.004	0.004

μ=0.940

	λ=0.25			λ=0.50			λ=0.75		
ν	J=0.25	J=0.50	J=0.75	J=0.25	J=0.50	J=0.75	J=0.25	J=0.50	J=0.75
0	-0.159	-0.168	-0.176	-0.107	-0.110	-0.113	-0.075	-0.077	-0.078
1	0	0	0	0	0	0	0	0	0
2	0.016	0.017	0.018	0.033	0.034	0.035	0.045	0.046	0.047
3	0	0	0	0	0	0	0	0	0
4	0.001	0.001	0.001	0.004	0.004	0.004	0.012	0.012	0.012
5	0	0	0	0	0	0	0	0	0
6	0.000	0.000	0.000	0.001	0.001	0.001	0.004	0.004	0.004

μ=0.970

	λ=0.25			λ=0.50			λ=0.75		
ν	J=0.25	J=0.50	J=0.75	J=0.25	J=0.50	J=0.75	J=0.25	J=0.50	J=0.75
0	-0.186	-0.197	-0.206	-0.118	-0.121	-0.124	-0.082	-0.083	-0.084
1	0	0	0	0	0	0	0	0	0
2	0.020	0.021	0.022	0.037	0.039	0.040	0.049	0.051	0.052
3	0	0	0	0	0	0	0	0	0
4	0.001	0.001	0.001	0.005	0.005	0.005	0.013	0.013	0.013
5	0	0	0	0	0	0	0	0	0
6	0.000	0.000	0.000	0.001	0.001	0.001	0.005	0.005	0.005

TABLE 8.15

ν^{TH} TERM OF PROPELLER-SHROUD THICKNESS CONTRIBUTION TO SHROUD THRUST COEFFICIENT $C_{T't_\nu}$

μ=0.900

	λ=0.25			λ=0.50			λ=0.75		
ν	J=0.25	J=0.50	J=0.75	J=0.25	J=0.50	J=0.75	J=0.25	J=0.50	J=0.75
0	-0.132	-0.138	-0.143	-0.094	-0.097	-0.099	-0.068	-0.069	-0.070
1	0	0	0	0	0	0	0	0	0
2	0.013	0.014	0.014	0.029	0.029	0.030	0.040	0.041	0.041
3	0	0	0	0	0	0	0	0	0
4	0.001	0.001	0.001	0.004	0.004	0.004	0.011	0.011	0.011
5	0	0	0	0	0	0	0	0	0
6	0.000	0.000	0.000	0.001	0.001	0.001	0.004	0.004	0.004

μ=0.940

	λ=0.25			λ=0.50			λ=0.75		
ν	J=0.25	J=0.50	J=0.75	J=0.25	J=0.50	J=0.75	J=0.25	J=0.50	J=0.75
0	-0.162	-0.170	-0.178	-0.107	-0.111	-0.113	-0.076	-0.077	-0.078
1	0	0	0	0	0	0	0	0	0
2	0.017	0.018	0.018	0.033	0.035	0.036	0.045	0.046	0.047
3	0	0	0	0	0	0	0	0	0
4	0.001	0.001	0.001	0.004	0.004	0.004	0.012	0.012	0.012
5	0	0	0	0	0	0	0	0	0
6	0.000	0.000	0.000	0.001	0.001	0.001	0.004	0.004	0.004

μ=0.970

	λ=0.25			λ=0.50			λ=0.75		
ν	J=0.25	J=0.50	J=0.75	J=0.25	J=0.50	J=0.75	J=0.25	J=0.50	J=0.75
0	-0.189	-0.199	-0.208	-0.119	-0.122	-0.125	-0.082	-0.083	-0.084
1	0	0	0	0	0	0	0	0	0
2	0.020	0.021	0.022	0.038	0.039	0.040	0.050	0.051	0.052
3	0	0	0	0	0	0	0	0	0
4	0.001	0.001	0.001	0.005	0.005	0.005	0.013	0.013	0.013
5	0	0	0	0	0	0	0	0	0
6	0.000	0.000	0.000	0.001	0.001	0.001	0.005	0.005	0.005

N= 6
e = 0.992
χ = 0.00

N = 3
e = 0.994
χ = 0.00

1C1

TABLE 8.16

ν^{TH} TERM OF PROPELLER-SHROUD THICKNESS CONTRIBUTION TO SHROUD THRUST COEFFICIENT $C_{T't_\nu}$

μ=0.900

	λ=0.25			λ=0.50			λ=0.75		
ν	J=0.25	J=0.50	J=0.75	J=0.25	J=0.50	J=0.75	J=0.25	J=0.50	J=0.75
0	-0.129	-0.137	-0.143	-0.093	-0.096	-0.098	-0.067	-0.069	-0.069
1	0	0	0	0	0	0	0	0	0
2	0.013	0.014	0.014	0.028	0.029	0.030	0.039	0.040	0.041
3	0	0	0	0	0	0	0	0	0
4	0.001	0.001	0.001	0.004	0.004	0.004	0.011	0.011	0.011
5	0	0	0	0	0	0	0	0	0
6	0.000	0.000	0.000	0.001	0.001	0.001	0.004	0.004	0.004

μ=0.940

	λ=0.25			λ=0.50			λ=0.75		
ν	J=0.25	J=0.50	J=0.75	J=0.25	J=0.50	J=0.75	J=0.25	J=0.50	J=0.75
0	-0.158	-0.169	-0.177	-0.106	-0.110	-0.113	-0.075	-0.077	-0.078
1	0	0	0	0	0	0	0	0	0
2	0.016	0.017	0.018	0.033	0.034	0.035	0.045	0.046	0.047
3	0	0	0	0	0	0	0	0	0
4	0.001	0.001	0.001	0.004	0.004	0.004	0.012	0.012	0.012
5	0	0	0	0	0	0	0	0	0
6	0.000	0.000	0.000	0.001	0.001	0.001	0.004	0.004	0.004

μ=0.970

	λ=0.25			λ=0.50			λ=0.75		
ν	J=0.25	J=0.50	J=0.75	J=0.25	J=0.50	J=0.75	J=0.25	J=0.50	J=0.75
0	-0.185	-0.197	-0.207	-0.117	-0.121	-0.125	-0.081	-0.083	-0.084
1	0	0	0	0	0	0	0	0	0
2	0.019	0.021	0.022	0.037	0.039	0.040	0.049	0.051	0.052
3	0	0	0	0	0	0	0	0	0
4	0.001	0.001	0.001	0.005	0.005	0.005	0.013	0.013	0.013
5	0	0	0	0	0	0	0	0	0
6	0.000	0.000	0.000	0.001	0.001	0.001	0.005	0.005	0.005

N=4
e = 0.994
χ = 0.00

TABLE 8.17

ν^{TH} TERM OF PROPELLER-SHROUD THICKNESS CONTRIBUTION TO SHROUD THRUST COEFFICIENT $C_{\Gamma' t_\nu}$

μ=0.900

	λ=0.25			λ=0.50			λ=0.75		
ν	J=0.25	J=0.50	J=0.75	J=0.25	J=0.50	J=0.75	J=0.25	J=0.50	J=0.75
0	-0.130	-0.137	-0.143	-0.093	-0.096	-0.098	-0.067	-0.069	-0.069
1	0	0	0	0	0	0	0	0	0
2	0.013	0.014	0.014	0.028	0.029	0.030	0.040	0.041	0.041
3	0	0	0	0	0	0	0	0	0
4	0.001	0.001	0.001	0.004	0.004	0.004	0.011	0.011	0.011
5	0	0	0	0	0	0	0	0	0
6	0.000	0.000	0.000	0.001	0.001	0.001	0.004	0.004	0.004

μ=0.940

	λ=0.25			λ=0.50			λ=0.75		
ν	J=0.25	J=0.50	J=0.75	J=0.25	J=0.50	J=0.75	J=0.25	J=0.50	J=0.75
0	-0.160	-0.169	-0.177	-0.107	-0.110	-0.113	-0.075	-0.077	-0.078
1	0	0	0	0	0	0	0	0	0
2	0.016	0.017	0.018	0.033	0.034	0.035	0.045	0.046	0.047
3	0	0	0	0	0	0	0	0	0
4	0.001	0.001	0.001	0.004	0.004	0.004	0.012	0.012	0.012
5	0	0	0	0	0	0	0	0	0
6	0.000	0.000	0.000	0.001	0.001	0.001	0.004	0.004	0.004

μ=0.970

	λ=0.25			λ=0.50			λ=0.75		
ν	J=0.25	J=0.50	J=0.75	J=0.25	J=0.50	J=0.75	J=0.25	J=0.50	J=0.75
0	-0.187	-0.198	-0.208	-0.118	-0.122	-0.125	-0.082	-0.083	-0.084
1	0	0	0	0	0	0	0	0	0
2	0.020	0.021	0.022	0.037	0.039	0.040	0.049	0.051	0.052
3	0	0	0	0	0	0	0	0	0
4	0.001	0.001	0.001	0.005	0.005	0.005	0.013	0.013	0.013
5	0	0	0	0	0	0	0	0	0
6	0.000	0.000	0.000	0.001	0.001	0.001	0.005	0.005	0.005

N=6
e=0.994
χ=0.00

TABLE 8.18

ν^{TH} TERM OF PROPELLER-SHROUD THICKNESS CONTRIBUTION TO SHROUD THRUST COEFFICIENT $C_{\Gamma' t_\nu}$

μ=0.900

	λ=0.25			λ=0.50			λ=0.75		
ν	J=0.25	J=0.50	J=0.75	J=0.25	J=0.50	J=0.75	J=0.25	J=0.50	J=0.75
0	-0.132	-0.139	-0.144	-0.094	-0.097	-0.099	-0.068	-0.069	-0.070
1	0	0	0	0	0	0	0	0	0
2	0.013	0.014	0.014	0.029	0.030	0.030	0.040	0.041	0.041
3	0	0	0	0	0	0	0	0	0
4	0.001	0.001	0.001	0.004	0.004	0.004	0.011	0.011	0.011
5	0	0	0	0	0	0	0	0	0
6	0.000	0.000	0.000	0.001	0.001	0.001	C.004	0.004	0.004

μ=0.940

	λ=0.25			λ=0.50			λ=0.75		
ν	J=0.25	J=0.50	J=0.75	J=0.25	J=0.50	J=0.75	J=0.25	J=0.50	J=0.75
0	-0.163	-0.171	-0.179	-0.108	-0.111	-0.113	-0.076	-0.077	-0.078
1	0	0	0	0	0	0	0	0	0
2	0.017	0.018	0.018	0.033	0.035	0.036	0.045	0.046	0.048
3	0	0	0	0	0	0	0	0	0
4	0.001	0.001	0.001	0.004	0.004	0.004	0.012	0.012	0.012
5	0	0	0	0	0	0	0	0	0
6	0.000	0.000	0.000	0.001	0.001	0.001	0.004	0.004	0.004

μ=0.970

	λ=0.25			λ=0.50			λ=0.75		
ν	J=0.25	J=0.50	J=0.75	J=0.25	J=0.50	J=0.75	J=0.25	J=0.50	J=0.75
0	-0.190	-0.200	-0.209	-0.119	-0.122	-0.125	-0.082	-0.084	-0.085
1	0	0	0	0	0	0	0	0	0
2	0.020	0.021	0.022	0.038	0.039	0.040	0.050	0.052	0.053
3	0	0	0	0	0	0	0	0	0
4	0.001	0.001	0.001	0.005	0.005	0.005	0.013	0.013	0.013
5	0	0	0	0	0	0	0	0	0
6	0.000	0.000	0.000	0.001	0.001	0.001	0.005	0.005	0.005

N=3
e=0.990
χ=0.25

TABLE 8.19

ν^{TH} TERM OF PROPELLER-SHROUD THICKNESS CONTRIBUTION TO SHROUD THRUST COEFFICIENT $C_{T'_{t_\nu}}$

μ=0.900

ν	λ=0.25 J=0.25	λ=0.25 J=0.50	λ=0.25 J=0.75	λ=0.50 J=0.25	λ=0.50 J=0.50	λ=0.50 J=0.75	λ=0.75 J=0.25	λ=0.75 J=0.50	λ=0.75 J=0.75
0	-0.236	-0.247	-0.256	-0.149	-0.152	-0.155	-0.100	-0.101	-0.101
1	-0.057	-0.060	-0.062	-0.054	-0.055	-0.056	-0.045	-0.046	-0.046
2	0.010	0.010	0.010	0.019	0.020	0.020	0.026	0.026	0.027
3	-0.001	-0.001	-0.001	-0.001	-0.001	0.000	0.001	0.001	0.001
4	0.000	0.000	0.000	0.003	0.003	0.003	0.009	0.009	0.010
5	0.000	0.000	0.000	0.000	0.000	0.000	0.001	0.001	0.001
6	0.000	0.000	0.000	0.000	0.000	0.000	0.004	0.004	0.004

μ=0.940

ν	λ=0.25 J=0.25	λ=0.25 J=0.50	λ=0.25 J=0.75	λ=0.50 J=0.25	λ=0.50 J=0.50	λ=0.50 J=0.75	λ=0.75 J=0.25	λ=0.75 J=0.50	λ=0.75 J=0.75
0	-0.279	-0.293	-0.304	-0.167	-0.171	-0.173	-0.110	-0.111	-0.111
1	-0.068	-0.072	-0.075	-0.061	-0.062	-0.063	-0.050	-0.051	-0.051
2	0.012	0.012	0.013	0.022	0.023	0.024	0.029	0.030	0.031
3	-0.001	-0.001	-0.001	0.000	0.000	0.000	0.001	0.002	0.002
4	0.000	0.001	0.001	0.003	0.004	0.004	0.011	0.011	0.011
5	0.000	0.000	0.000	0.000	0.000	0.000	0.001	0.002	0.002
6	0.000	0.000	0.000	0.001	0.001	0.001	0.004	0.004	0.004

μ=0.970

ν	λ=0.25 J=0.25	λ=0.25 J=0.50	λ=0.25 J=0.75	λ=0.50 J=0.25	λ=0.50 J=0.50	λ=0.50 J=0.75	λ=0.75 J=0.25	λ=0.75 J=0.50	λ=0.75 J=0.75
0	-0.315	-0.331	-0.344	-0.181	-0.185	-0.188	-0.118	-0.119	-0.120
1	-0.078	-0.082	-0.086	-0.066	-0.068	-0.069	-0.054	-0.054	-0.055
2	0.014	0.015	0.015	0.025	0.026	0.027	0.032	0.033	0.034
3	-0.001	0.000	0.000	0.000	0.000	0.000	0.002	0.003	0.003
4	0.001	0.001	0.001	0.004	0.004	0.004	0.012	0.012	0.012
5	0.000	0.000	0.000	0.000	0.000	0.000	0.002	0.002	0.002
6	0.000	0.000	0.000	0.001	0.001	0.001	0.005	0.005	0.005

N= 4
e = 0.990
χ = 0.25

TABLE 8.20

ν^{TH} TERM OF PROPELLER-SHROUD THICKNESS CONTRIBUTION TO SHROUD THRUST COEFFICIENT $C_{T'_{t_\nu}}$

μ=0.900

	λ=0.25			λ=0.50			λ=0.75		
ν	J=0.25	J=0.50	J=0.75	J=0.25	J=0.50	J=0.75	J=0.25	J=0.50	J=0.75
0	-0.238	-0.248	-0.257	-0.150	-0.153	-0.155	-0.100	-0.101	-0.101
1	-0.058	-0.060	-0.062	-0.054	-0.055	-0.056	-0.046	-0.046	-0.046
2	0.010	0.010	0.011	0.019	0.020	0.020	0.026	0.026	0.027
3	-0.001	-0.001	-0.001	-0.001	-0.001	0.000	0.001	0.001	0.001
4	0.000	0.000	0.000	0.003	0.003	0.003	0.009	0.009	0.010
5	0.000	0.000	0.000	0.000	0.000	0.000	0.001	0.001	0.001
6	0.000	0.000	0.000	0.000	0.000	0.000	0.004	0.004	0.004

μ=0.940

	λ=0.25			λ=0.50			λ=0.75		
ν	J=0.25	J=0.50	J=0.75	J=0.25	J=0.50	J=0.75	J=0.25	J=0.50	J=0.75
0	-0.281	-0.294	-0.304	-0.168	-0.171	-0.174	-0.110	-0.111	-0.112
1	-0.069	-0.072	-0.075	-0.061	-0.062	-0.063	-0.052	-0.051	-0.051
2	0.012	0.012	0.013	0.022	0.023	0.024	0.029	0.030	0.031
3	-0.001	-0.001	-0.001	0.000	0.000	0.000	0.002	0.002	0.002
4	0.000	0.001	0.001	0.003	0.004	0.004	0.011	0.011	0.011
5	0.000	0.000	0.000	0.000	0.000	0.000	0.002	0.002	0.002
6	0.000	0.000	0.000	0.001	0.001	0.001	0.004	0.004	0.004

μ=0.970

	λ=0.25			λ=0.50			λ=0.75		
ν	J=0.25	J=0.50	J=0.75	J=0.25	J=0.50	J=0.75	J=0.25	J=0.50	J=0.75
0	-0.318	-0.333	-0.345	-0.182	-0.186	-0.189	-0.118	-0.119	-0.120
1	-0.079	-0.083	-0.086	-0.066	-0.068	-0.069	-0.054	-0.054	-0.055
2	0.014	0.015	0.015	0.025	0.026	0.027	0.032	0.033	0.034
3	0.000	0.000	0.000	0.000	0.000	0.000	0.002	0.003	0.003
4	0.001	0.001	0.001	0.004	0.004	0.004	0.012	0.012	0.012
5	0.000	0.000	0.000	0.000	0.000	0.000	0.002	0.002	0.002
6	0.000	0.000	0.000	0.001	0.001	0.001	0.005	0.005	0.005

N = 6
e = 0.990
x = 0.25

TABLE 8.21

ν^{TH} TERM OF PROPELLER-SHROUD THICKNESS CONTRIBUTION TO SHROUD THRUST COEFFICIENT $C_{T'_{t_\nu}}$

μ=0.900

	λ=0.25			λ=0.50			λ=0.75		
ν	J=0.25	J=0.50	J=0.75	J=0.25	J=0.50	J=0.75	J=0.25	J=0.50	J=0.75
0	-0.242	-0.251	-0.258	-0.151	-0.153	-0.155	-0.100	-0.101	-0.101
1	-0.053	-0.061	-0.063	-0.054	-0.056	-0.057	-0.046	-0.046	-0.046
2	0.010	0.010	0.011	0.019	0.020	0.020	0.026	0.027	0.027
3	-0.001	-0.001	-0.001	-0.001	0.000	0.000	0.001	0.001	0.001
4	0.000	0.000	0.000	0.003	0.003	0.003	0.009	0.010	0.010
5	0.000	0.000	0.000	0.000	0.000	0.000	0.001	0.001	0.001
6	0.000	0.000	0.000	0.000	0.000	0.000	0.004	0.004	0.004

μ=0.940

	λ=0.25			λ=0.50			λ=0.75		
ν	J=0.25	J=0.50	J=0.75	J=0.25	J=0.50	J=0.75	J=0.25	J=0.50	J=0.75
0	-0.286	-0.297	-0.306	-0.169	-0.172	-0.174	-0.110	-0.111	-0.112
1	-0.079	-0.073	-0.076	-0.061	-0.063	-0.064	-0.050	-0.051	-0.051
2	0.012	0.013	0.013	0.023	0.023	0.024	0.030	0.030	0.031
3	-0.001	-0.001	-0.001	0.000	0.000	0.000	0.002	0.002	0.002
4	0.001	0.001	0.001	0.004	0.004	0.004	0.011	0.011	0.011
5	0.000	0.000	0.000	0.000	0.000	0.000	0.002	0.002	0.002
6	0.000	0.000	0.000	0.001	0.001	0.001	0.004	0.004	0.004

μ=0.970

	λ=0.25			λ=0.50			λ=0.75		
ν	J=0.25	J=0.50	J=0.75	J=0.25	J=0.50	J=0.75	J=0.25	J=0.50	J=0.75
0	-0.323	-0.336	-0.347	-0.183	-0.186	-0.189	-0.118	-0.119	-0.120
1	-0.080	-0.084	-0.087	-0.067	-0.068	-0.069	-0.054	-0.055	-0.055
2	0.014	0.015	0.016	0.025	0.026	0.027	0.033	0.033	0.034
3	0.000	0.000	0.000	0.000	0.000	0.000	0.003	0.003	0.004
4	0.001	0.001	0.001	0.004	0.004	0.004	0.012	0.012	0.012
5	0.000	0.000	0.000	0.000	0.000	0.000	0.002	0.002	0.002
6	0.000	0.000	0.000	0.001	0.001	0.001	0.005	0.005	0.005

N= 3
e = 0.992
χ = 0.25

TABLE 8.22

ν^{TH} TERM OF PROPELLER-SHROUD THICKNESS CONTRIBUTION TO SHROUD THRUST COEFFICIENT $C_{T'_{t_\nu}}$

μ=0.900

ν	λ=0.25 J=0.25	λ=0.25 J=0.50	λ=0.25 J=0.75	λ=0.50 J=0.25	λ=0.50 J=0.50	λ=0.50 J=0.75	λ=0.75 J=0.25	λ=0.75 J=0.50	λ=0.75 J=0.75
0	-0.237	-0.248	-0.257	-0.150	-0.153	-0.155	-0.100	-0.101	-0.101
1	-0.057	-0.060	-0.063	-0.054	-0.055	-0.056	-0.045	-0.046	-0.046
2	0.010	0.010	0.011	0.019	0.020	0.020	0.026	0.026	0.027
3	-0.001	-0.001	-0.001	-0.001	-0.001	0.000	0.001	0.001	0.001
4	0.000	0.000	0.000	0.003	0.003	0.003	0.009	0.009	0.010
5	0.000	0.000	0.000	0.000	0.000	0.000	0.001	0.001	0.001
6	0.000	0.000	0.000	0.000	0.000	0.000	0.004	0.004	0.004

μ=0.940

ν	λ=0.25 J=0.25	λ=0.25 J=0.50	λ=0.25 J=0.75	λ=0.50 J=0.25	λ=0.50 J=0.50	λ=0.50 J=0.75	λ=0.75 J=0.25	λ=0.75 J=0.50	λ=0.75 J=0.75
0	-0.280	-0.294	-0.305	-0.167	-0.171	-0.174	-0.110	-0.111	-0.112
1	-0.069	-0.072	-0.075	-0.061	-0.062	-0.064	-0.050	-0.051	-0.051
2	0.012	0.012	0.013	0.022	0.023	0.024	0.029	0.030	0.031
3	-0.001	-0.001	-0.001	0.000	0.000	0.000	0.001	0.002	0.002
4	0.000	0.001	0.001	0.003	0.004	0.004	0.011	0.011	0.011
5	0.000	0.000	0.000	0.000	0.000	0.000	0.001	0.002	0.002
6	0.000	0.000	0.000	0.001	0.001	0.001	0.004	0.004	0.004

μ=0.970

ν	λ=0.25 J=0.25	λ=0.25 J=0.50	λ=0.25 J=0.75	λ=0.50 J=0.25	λ=0.50 J=0.50	λ=0.50 J=0.75	λ=0.75 J=0.25	λ=0.75 J=0.50	λ=0.75 J=0.75
0	-0.316	-0.333	-0.345	-0.182	-0.186	-0.189	-0.118	-0.119	-0.120
1	-0.078	-0.083	-0.086	-0.066	-0.068	-0.069	-0.054	-0.054	-0.055
2	0.014	0.015	0.015	0.025	0.026	0.027	0.032	0.033	0.034
3	0.000	0.000	0.000	0.000	0.000	0.000	0.002	0.003	0.003
4	0.001	0.001	0.001	0.004	0.004	0.004	0.012	0.012	0.012
5	0.000	0.000	0.000	0.000	0.000	0.000	0.002	0.002	0.002
6	0.000	0.000	0.000	0.001	0.001	0.001	0.005	0.005	0.005

N=4
e=0.992
χ=0.25

TABLE 8.23

ν^{TH} TERM OF PROPELLER-SHROUD THICKNESS CONTRIBUTION TO SHROUD THRUST COEFFICIENT $C_{T'_{t_\nu}}$

μ=0.900

ν	λ=0.25 J=0.25	λ=0.25 J=0.50	λ=0.25 J=0.75	λ=0.50 J=0.25	λ=0.50 J=0.50	λ=0.50 J=0.75	λ=0.75 J=0.25	λ=0.75 J=0.50	λ=0.75 J=0.75
0	-0.239	-0.238	-0.258	-0.150	-0.150	-0.155	-0.100	-0.100	-0.101
1	-0.058	-0.058	-0.063	-0.054	-0.054	-0.056	-0.046	-0.046	-0.046
2	0.010	0.010	0.011	0.019	0.019	0.020	0.026	0.026	0.027
3	-0.001	-0.001	-0.001	-0.001	-0.001	0.000	0.001	0.001	0.001
4	0.000	0.000	0.000	0.003	0.003	0.003	0.009	0.009	0.010
5	0.000	0.000	0.000	0.000	0.000	0.000	0.001	0.001	0.001
6	0.000	0.000	0.000	0.000	0.000	0.000	0.004	0.004	0.004

μ=0.940

ν	λ=0.25 J=0.25	λ=0.25 J=0.50	λ=0.25 J=0.75	λ=0.50 J=0.25	λ=0.50 J=0.50	λ=0.50 J=0.75	λ=0.75 J=0.25	λ=0.75 J=0.50	λ=0.75 J=0.75
0	-0.282	-0.295	-0.306	-0.168	-0.171	-0.174	-0.110	-0.111	-0.112
1	-0.069	-0.073	-0.076	-0.061	-0.062	-0.064	-0.050	-0.051	-0.051
2	0.012	0.013	0.013	0.022	0.023	0.024	0.029	0.030	0.031
3	-0.001	-0.001	-0.001	0.000	0.000	0.000	0.002	0.002	0.002
4	0.000	0.001	0.001	0.003	0.004	0.004	0.011	0.011	0.011
5	0.000	0.000	0.000	0.000	0.000	0.000	0.002	0.002	0.002
6	0.000	0.000	0.000	0.001	0.001	0.001	0.004	0.004	0.004

μ=0.970

ν	λ=0.25 J=0.25	λ=0.25 J=0.50	λ=0.25 J=0.75	λ=0.50 J=0.25	λ=0.50 J=0.50	λ=0.50 J=0.75	λ=0.75 J=0.25	λ=0.75 J=0.50	λ=0.75 J=0.75
0	-0.319	-0.334	-0.316	-0.182	-0.186	-0.189	-0.118	-0.119	-0.120
1	-0.079	-0.083	-0.087	-0.066	-0.068	-0.069	-0.054	-0.054	-0.055
2	0.014	0.015	0.016	0.025	0.026	0.027	0.032	0.033	0.034
3	0.000	0.000	0.000	0.000	0.000	0.000	0.002	0.003	0.003
4	0.001	0.001	0.001	0.004	0.004	0.004	0.012	0.012	0.012
5	0.000	0.000	0.000	0.000	0.000	0.000	0.002	0.002	0.002
6	0.000	0.000	0.000	0.001	0.001	0.001	0.005	0.005	0.005

N= 6
e = 0.992
χ = 0.25

TABLE 8.24

ν^{TH} TERM OF PROPELLER-SHROUD THICKNESS CONTRIBUTION TO SHROUD THRUST COEFFICIENT C_{T',t_ν}

μ=0.900

	λ=0.25			λ=0.50			λ=0.75		
ν	J=0.25	J=0.50	J=0.75	J=0.25	J=0.50	J=0.75	J=0.2	J=0.50	J=0.75
0	-0.242	-0.251	-0.259	-0.151	-0.153	-0.155	-0.100	-0.101	-0.101
1	-0.059	-0.061	-0.063	-0.055	-0.056	-0.057	-0.046	-0.046	-0.046
2	0.010	0.010	0.011	0.019	0.020	0.020	0.026	0.027	0.027
3	-0.001	-0.001	-0.001	-0.001	0.000	0.000	0.001	0.001	0.001
4	0.000	0.000	0.000	0.003	0.003	0.003	0.009	0.010	0.010
5	0.000	0.000	0.000	0.000	0.000	0.000	0.001	0.001	0.001
6	0.000	0.000	0.000	0.000	0.000	0.000	0.004	0.004	0.0[illegible]

μ=0.940

	λ=0.25			λ=0.50			λ=0.75		
ν	J=0.25	J=0.50	J=0.75	J=0.25	J=0.50	J=0.75	J=0.25	J=0.50	J=0.75
0	-0.286	-0.298	-0.307	-0.169	-0.172	-0.174	-0.110	-0.111	-0.112
1	-0.070	-0.073	-0.076	-0.061	-0.063	-0.064	-0.050	-0.051	-0.051
2	0.012	0.013	0.013	0.023	0.023	0.024	0.030	0.030	0.031
3	-0.001	-0.001	-0.001	0.001	0.000	0.000	0.002	0.002	0.002
4	0.001	0.001	0.001	0.004	0.004	0.004	0.011	0.011	0.011
5	0.000	0.000	0.000	0.000	0.000	0.000	0.002	0.002	0.002
6	0.000	0.000	0.000	0.001	0.001	0.001	0.004	0.004	0.004

μ=0.970

	λ=0.25			λ=0.50			λ=0.75		
ν	J=0.25	J=0.50	J=0.75	J=0.25	J=0.50	J=0.75	J=0.25	J=0.50	J=0.75
0	-0.323	-0.337	-0.348	-0.183	-0.187	-0.189	-0.118	-0.119	-0.120
1	-0.080	-0.084	-0.087	-0.067	-0.068	-0.069	-0.054	-0.055	-0.055
2	0.014	0.015	0.016	0.025	0.026	0.027	0.033	0.033	0.034
3	0.000	0.000	0.000	0.000	0.000	0.000	0.003	0.003	0.004
4	0.001	0.001	0.001	0.004	0.004	0.004	0.012	0.012	0.012
5	0.000	0.000	0.000	0.000	0.000	0.000	0.002	0.002	0.002
6	0.000	0.000	0.000	0.001	0.001	0.001	0.005	0.005	0.005

N=3
e=0.994
x=0.25

TABLE 8.25

ν^{TH} TERM OF PROPELLER-SHROUD THICKNESS CONTRIBUTION TO SHROUD THRUST COEFFICIENT $C_{T'_{t_\nu}}$

μ=0.900

	λ=0.25			λ=0.50			λ=0.75		
ν	J=0.25	J=0.50	J=0.75	J=0.25	J=0.50	J=0.75	J=0.25	J=0.50	J=0.75
0	-0.238	-0.249	-0.258	-0.150	-0.153	-0.155	-0.100	-0.101	-0.101
1	-0.057	-0.061	-0.063	-0.054	-0.055	-0.056	-0.045	-0.046	-0.046
2	0.010	0.010	0.011	0.019	0.020	0.020	0.026	0.026	0.027
3	-0.001	-0.001	-0.001	-0.001	-0.001	0.000	0.001	0.001	0.001
4	0.000	0.000	0.000	0.003	0.003	0.003	0.009	0.009	0.010
5	0.000	0.000	0.000	0.000	0.000	0.000	0.001	0.001	0.001
6	0.000	0.000	0.000	0.000	0.000	0.000	0.004	0.004	0.004

μ=0.940

	λ=0.25			λ=0.50			λ=0.75		
ν	J=0.25	J=0.50	J=0.75	J=0.25	J=0.50	J=0.75	J=0.25	J=0.50	J=0.75
0	-0.281	-0.295	-0.306	-0.168	-0.171	-0.174	-0.110	-0.111	-0.112
1	-0.069	-0.073	-0.076	-0.061	-0.062	-0.064	-0.050	-0.051	-0.051
2	0.012	0.013	0.013	0.022	0.023	0.024	0.029	0.030	0.031
3	-0.001	-0.001	-0.001	0.000	0.000	0.000	0.001	0.002	0.002
4	0.000	0.001	0.001	0.003	0.004	0.004	0.011	0.011	0.011
5	0.000	0.000	0.000	0.000	0.000	0.000	0.001	0.002	0.002
6	0.000	0.000	0.000	0.001	0.001	0.001	0.004	0.004	0.004

μ=0.970

	λ=0.25			λ=0.50			λ=0.75		
ν	J=0.25	J=0.50	J=0.75	J=0.25	J=0.50	J=0.75	J=0.25	J=0.50	J=0.75
0	-0.317	-0.334	-0.347	-0.182	-0.186	-0.189	-0.118	-0.119	-0.120
1	-0.079	-0.083	-0.087	-0.066	-0.068	-0.069	-0.054	-0.054	-0.055
2	0.014	0.015	0.016	0.025	0.026	0.027	0.032	0.033	0.034
3	0.000	0.000	0.000	0.000	0.000	0.000	0.002	0.003	0.004
4	0.001	0.001	0.001	0.004	0.004	0.004	0.012	0.012	0.012
5	0.000	0.000	0.000	0.000	0.000	0.000	0.002	0.002	0.002
6	0.000	0.000	0.000	0.001	0.001	0.001	0.005	0.005	0.005

N= 4
e = 0. 994
χ = 0. 25

TABLE 8.26

ν^{TH} TERM OF PROPELLER-SHROUD THICKNESS CONTRIBUTION TO SHROUD THRUST COEFFICIENT $C_{T'_{t_\nu}}$

μ=0.900

	λ=0.25			λ=0.50			λ=0.75		
ν	J=0.25	J=0.50	J=0.75	J=0.25	J=0.50	J=0.75	J=0.25	J=0.50	J=0.75
0	-0.240	-0.250	-0.259	-0.150	-0.152	-0.155	-0.100	-0.101	-0.101
1	-0.058	-0.061	-0.063	-0.054	-0.056	-0.057	-0.046	-0.046	-0.046
2	0.010	0.010	0.011	0.019	0.020	0.020	0.026	0.027	0.027
3	-0.001	-0.001	-0.001	-0.001	0.000	0.000	0.001	0.001	0.001
4	0.000	0.000	0.000	0.003	0.003	0.003	0.009	0.009	0.010
5	0.000	0.000	0.000	0.000	0.000	0.000	0.001	0.001	0.001
6	0.000	0.000	0.000	0.000	0.000	0.000	0.004	0.004	0.004

μ=0.940

	λ=0.25			λ=0.50			λ=0.75		
ν	J=0.25	J=0.50	J=0.75	J=0.25	J=0.50	J=0.75	J=0.25	J=0.50	J=0.75
0	-0.283	-0.296	-0.307	-0.168	-0.172	-0.174	-0.110	-0.111	-0.112
1	-0.069	-0.073	-0.076	-0.061	-0.063	-0.064	-0.050	-0.051	-0.051
2	0.012	0.013	0.013	0.022	0.023	0.024	0.030	0.030	0.031
3	-0.001	-0.001	-0.001	0.000	0.000	0.000	0.002	0.002	0.002
4	0.001	0.001	0.001	0.003	0.004	0.004	0.011	0.011	0.011
5	0.000	0.000	0.000	0.000	0.000	0.000	0.002	0.002	0.002
6	0.000	0.000	0.000	0.001	0.001	0.001	0.004	0.004	0.004

μ=0.970

	λ=0.25			λ=0.50			λ=0.75		
ν	J=0.25	J=0.50	J=0.75	J=0.25	J=0.50	J=0.75	J=0.25	J=0.50	J=0.75
0	-0.320	-0.336	-0.348	-0.182	-0.186	-0.189	-0.118	-0.119	-0.120
1	-0.079	-0.084	-0.087	-0.066	-0.068	-0.069	-0.054	-0.054	-0.055
2	0.014	0.015	0.016	0.025	0.026	0.027	0.033	0.033	0.034
3	0.000	0.000	0.000	0.000	0.000	0.000	0.002	0.003	0.004
4	0.001	0.001	0.001	0.004	0.004	0.004	0.012	0.012	0.012
5	0.000	0.000	0.000	0.000	0.000	0.000	0.002	0.002	0.002
6	0.000	0.000	0.000	0.001	0.001	0.001	0.005	0.005	0.005

N=6
e=0.994
χ=0.25

TABLE 8.27

ν^{TH} TERM OF PROPELLER-SHROUD THICKNESS CONTRIBUTION TO SHROUD THRUST COEFFICIENT $C_{T''t_\nu}$

μ=0.900

	λ=0.25			λ=0.50			λ=0.75		
ν	J=0.25	J=0.50	J=0.75	J=0.25	J=0.50	J=0.75	J=0.25	J=0.50	J=0.75
0	-0.243	-0.252	-0.260	-0.151	-0.154	-0.156	-0.100	-0.101	-0.101
1	-0.059	-0.061	-0.063	-0.055	-0.056	-0.057	-0.046	-0.046	-0.047
2	0.010	0.010	0.011	0.020	0.020	0.021	0.026	0.027	0.027
3	-0.001	-0.001	-0.001	-0.001	0.000	0.000	0.001	0.001	0.001
4	0.000	0.000	0.000	0.003	0.003	0.003	0.009	0.010	0.010
5	0.000	0.000	0.000	0.000	0.000	0.000	0.001	0.001	0.001
6	0.000	0.000	0.000	0.000	0.000	0.000	0.004	0.004	0.004

μ=0.940

	λ=0.25			λ=0.50			λ=0.75		
ν	J=0.25	J=0.50	J=0.75	J=0.25	J=0.50	J=0.75	J=0.25	J=0.50	J=0.75
0	-0.287	-0.299	-0.309	-0.169	-0.172	-0.175	-0.110	-0.111	-0.112
1	-0.071	-0.074	-0.076	-0.061	-0.063	-0.064	-0.950	-0.051	-0.051
2	0.012	0.013	0.013	0.023	0.023	0.024	0.030	0.030	0.031
3	-0.001	-0.001	-0.001	0.001	0.000	0.000	0.002	0.002	0.002
4	0.001	0.001	0.001	0.004	0.004	0.004	0.011	0.011	0.011
5	0.000	0.000	0.000	0.000	0.001	0.000	0.002	0.002	0.002
6	0.000	0.000	0.000	0.001	0.000	0.001	0.004	0.004	0.004

μ=0.970

	λ=0.25			λ=0.50			λ=0.75		
ν	J=0.25	J=0.50	J=0.75	J=0.25	J=0.50	J=0.75	J=0.25	J=0.50	J=0.75
0	-0.324	-0.338	-0.350	-0.183	-0.187	-0.190	-0.118	-0.119	-0.120
1	-0.081	-0.084	-0.088	-0.067	-0.068	-0.070	-0.054	-0.055	-0.055
2	0.014	0.015	0.016	0.025	0.026	0.027	0.033	0.034	0.034
3	0.000	0.000	0.000	0.000	0.000	0.001	0.003	0.003	0.004
4	0.001	0.001	0.001	0.004	0.004	0.004	0.012	0.012	0.012
5	0.000	0.000	0.000	0.000	0.000	0.000	0.002	0.002	0.002
6	0.000	0.000	0.000	0.001	0.001	0.001	0.005	0.005	0.005

TABLES 9.1 - 9.3

ELEMENTS FOR SHROUD CURVATURE CONTRIBUTION TO SHROUD SURFACE PRESSURE ARISING FROM EFFECTIVE SHROUD CAMBER $S_{k,\ell}$

See Ref. 5, Section 3.4 . These elements have been taken directly from Tables 3.12 - 3.14 .

Accuracy: ± 0.0001

λ=0.25

TABLE 9.1

ELEMENTS FOR SHROUD CURVATURE CONTRIBUTION TO SHROUD SURFACE PRESSURE ARISING FROM EFFECTIVE SHROUD CAMBER $S_{k,\ell}$

k \ ℓ	0	1	2	3	4	5	6
0	0.7845	0.3927	0	-0.0005	0	0.0000	0
1	-0.2544	0	-0.1273	0	0.0001	0	0.0000
2	0.0018	0.0637	0	-0.0628	0	0.0000	0
3	0.0003	0	0.0419	0	-0.0417	0	0.0000
4	0.0000	0.0000	0	0.0313	0	-0.0313	0
5	0.0000	0	0.0000	0	0.0250	0	-0.0250
6	0.0000	0.0000	0	0.0000	0	0.0208	0

λ=0.50

TABLE 9.2

ELEMENTS FOR SHROUD CURVATURE CONTRIBUTION TO SHROUD SURFACE PRESSURE ARISING FROM EFFECTIVE SHROUD CAMBER $S_{k,\ell}$

k \ ℓ	0	1	2	3	4	5	6
0	1.2088	0.6058	0	-0.0014	0	0.0000	0
1	-0.5177	0	-0.2599	0	0.0011	0	0.0000
2	0.0057	0.1300	0	-0.1274	0	0.0003	0
3	0.0021	0	0.0849	0	-0.0840	0	0.0001
4	0.0000	-0.0003	0	0.0630	0	-0.0628	0
5	0.0000	0	-0.0001	0	0.0502	0	-0.0501
6	0.0000	0.0000	0	-0.0001	0	0.0418	0

TABLE 9.3

ELEMENTS FOR SHROUD CURVATURE CONTRIBUTION TO SHROUD SURFACE PRESSURE ARISING FRCM EFFECTIVE SHROUD CAMBER $S_{k,l}$

k \ l	0	1	2	3	4	5	6
0	1.4971	0.7496	0	-0.0009	0	-0.0001	0
1	-0.7777	0	-0.3919	0	0.0031	0	0.0000
2	0.0040	0.1959	0	-0.1950	0	0.0010	0
3	0.0061	0	0.1300	0	-0.1273	0	0.0004
4	0.0065	-0.0008	0	0.0955	0	-0.0947	0
5	0.0000	0	-0.0004	0	0.0757	0	-0.0755
6	0.0000	0.0000	0	-0.0002	0	0.0629	0

TABLES 10.1 - 10.3

ELEMENTS FOR SHROUD CURVATURE CONTRIBUTION TO SHROUD SURFACE PRESSURE ARISING FROM SHROUD THICKNESS $T_{k,\ell}$

See Ref. 5, Section 3.3. These elements have been taken directly from Tables 3.7 - 3.9.

Accuracy: ± 0.0001

$\lambda=0.25$

TABLE 10.1

ELEMENTS FOR SHROUD CURVATURE CONTRIBUTION TO SHROUD SURFACE PRESSURE ARISING FROM SHROUD THICKNESS $T_{k,\ell}$

k \ ℓ	0	1	2	3	4	5	6
0	0.0150	0	-0.0013	0	0.0000	0	0.0000
1	0.0460	0.0177	0	0.0003	0	0.0000	0
2	0.0048	0	-0.0004	0	0.0000	0	0.0000
3	-0.0003	-0.0005	0	0.0000	0	0.0000	0
4	0.0301	0	0.0000	0	0.0000	0	0.0000
5	0.0000	0.0000	0	0.0000	0	0.0000	0
6	0.0001	0	0.0000	0	0.0000	0	0.0000

$\lambda=0.50$

TABLE 10.2

ELEMENTS FOR SHROUD CURVATURE CONTRIBUTION TO SHROUD SURFACE PRESSURE ARISING FROM SHROUD THICKNESS $T_{k,\ell}$

k \ ℓ	0	1	2	3	4	5	6
0	0.0224	0	-0.0056	0	-0.0008	0	-0.0002
1	0.0702	0.0408	0	0.3024	0	0.0003	0
2	0.0140	0	-0.0036	0	-0.0006	0	-0.0001
3	-0.0009	-0.0022	0	0.0002	0	0.0000	0
4	0.0000	0	0.0000	0	0.0000	0	0.0000
5	0.0000	-0.0001	0	-0.0001	0	0.0000	0
6	0.0000	0	0.0000	0	0.0000	0	0.0000

$\lambda=0.75$

TABLE 10.3

ELEMENTS FOR SHROUD CURVATURE CONTRIBUTION TO SHROUD SURFACE PRESSURE ARISING FROM SHROUD THICKNESS $T_{k,\ell}$

k \ ℓ	0	1	2	3	4	5	6
0	0.0212	0	-0.0096	0	-0.0033	0	-0.0013
1	0.0685	0.0540	0	0.0056	0	0.0012	0
2	0.0239	0	-0.0115	0	-0.0040	0	-0.0015
3	-0.0002	-0.0043	0	0.0014	0	0.0007	0
4	0.0000	0	-0.0002	0	0.0000	0	-0.0001
5	-0.0002	-0.0002	0	-0.0003	0	0.0000	0
6	0.0000	0	-0.0001	0	0.0001	0	0.0000

TABLES 11.1 - 11.18

DIRECT PROPELLER CONTRIBUTION TO SHROUD SURFACE PRESSURE COEFFICIENT $c_{\Gamma'}(x/c)$ FOR $C_T = 1$

$$c_{\Gamma'}(x/c) = \lambda\,(x/c - \chi)\,\frac{N\mu}{2\pi^2 J}\int_0^{\pi/2} \frac{\frac{\Gamma(\beta)}{R_p U}\,\sin\beta}{\sqrt{\mu\cos\beta}\,(\omega^2-1)}\left[\omega Q_{-\frac{1}{2}}(\omega) - Q_{\frac{1}{2}}(\omega)\right] d\beta$$

$$\omega \equiv 1 + \frac{\lambda^2\,(-2x/c+2\chi)^2 + (1-\mu\cos\beta)^2}{2\mu\cos\beta}$$

Accuracy: $\pm\,0.001$

FOR $\chi = 0.25$, USE THE TABLES FOR $\chi = -0.25$ WITH EACH COLUMN INVERTED AND THE SIGN OF EACH NUMBER REVERSED.

N=3
e=0.990
χ=-0.25

TABLE 11.1

DIRECT PROPELLER CONTRIBUTION TO SHROUD SURFACE PRESSURE COEFFICIENT c_{Γ}, (x/c)

μ=0.903

	λ=0.25			λ=0.50			λ=0.75		
x/c	J=0.25	J=0.50	J=0.75	J=0.25	J=0.50	J=0.75	J=0.25	J=0.50	J=0.75
-0.5	-0.095	-0.101	-0.107	-0.118	-0.124	-0.129	-0.117	-0.121	-0.124
-0.4	-0.068	-0.074	-0.078	-0.103	-0.110	-0.116	-0.116	-0.122	-0.128
-0.3	-0.026	-0.028	-0.030	-0.049	-0.053	-0.057	-0.068	-0.074	-0.078
-0.2	0.026	0.028	0.030	0.049	0.053	0.057	0.068	0.074	0.078
-0.1	0.068	0.074	0.078	0.103	0.110	0.116	0.116	0.122	0.128
0	0.095	0.101	0.107	0.118	0.124	0.129	0.117	0.121	0.124
0.1	0.109	0.116	0.122	0.118	0.122	0.126	0.107	0.109	0.111
0.2	0.116	0.122	0.128	0.113	0.116	0.118	0.096	0.097	0.097
0.3	0.119	0.124	0.129	0.105	0.107	0.109	0.085	0.085	0.085
0.4	0.119	0.123	0.127	0.098	0.099	0.100	0.075	0.075	0.075
0.5	0.117	0.121	0.124	0.090	0.091	0.091	0.066	0.066	0.066
x	0	0	0	0	0	0	0	0	0

μ=0.940

	λ=0.25			λ=0.50			λ=0.75		
x/c	J=0.25	J=0.50	J=0.75	J=0.25	J=0.50	J=0.75	J=0.25	J=0.50	J=0.75
-0.5	-0.125	-0.135	-0.143	-0.140	-0.147	-0.153	-0.133	-0.138	-0.141
-0.4	-0.099	-0.108	-0.115	-0.132	-0.141	-0.150	-0.140	-0.148	-0.154
-0.3	-0.042	-0.046	-0.050	-0.075	-0.082	-0.089	-0.099	-0.108	-0.115
-0.2	0.042	0.046	0.050	0.075	0.082	0.089	0.099	0.108	0.115
-0.1	0.099	0.108	0.115	0.132	0.141	0.150	0.140	0.148	0.154
0	0.125	0.135	0.143	0.140	0.147	0.153	0.133	0.138	0.141
0.1	0.136	0.145	0.153	0.135	0.140	0.144	0.119	0.122	0.123
0.2	0.140	0.148	0.154	0.126	0.130	0.132	0.105	0.106	0.107
0.3	0.139	0.146	0.152	0.117	0.119	0.121	0.093	0.093	0.093
0.4	0.137	0.143	0.147	0.108	0.109	0.110	0.081	0.081	0.081
0.5	0.133	0.138	0.141	0.099	0.099	0.100	0.072	0.072	0.071
x	0	0	0	0	0	0	0	0	0

μ=0.970

	λ=0.25			λ=0.50			λ=0.75		
x/c	J=0.25	J=0.50	J=0.75	J=0.25	J=0.50	J=0.75	J=0.25	J=0.50	J=0.75
-0.5	-0.154	-0.167	-0.178	-0.158	-0.174	-0.167	-0.146	-0.151	-0.155
-0.4	-0.134	-0.147	-0.159	-0.158	-0.181	-0.170	-0.159	-0.169	-0.177
-0.3	-0.070	-0.078	-0.085	-0.112	-0.134	-0.124	-0.134	-0.147	-0.159
-0.2	0.070	0.078	0.085	0.112	0.134	0.124	0.134	0.147	0.159
-0.1	0.134	0.147	0.159	0.158	0.181	0.170	0.159	0.169	0.177
0	0.154	0.167	0.178	0.158	0.174	0.167	0.146	0.151	0.155
0.1	0.160	0.171	0.181	0.149	0.159	0.155	0.129	0.131	0.133
0.2	0.159	0.169	0.177	0.137	0.144	0.141	0.113	0.114	0.115
0.3	0.156	0.164	0.170	0.126	0.130	0.128	0.099	0.099	0.099
0.4	0.151	0.158	0.163	0.115	0.117	0.116	0.086	0.086	0.086
0.5	0.146	0.151	0.155	0.105	0.106	0.106	0.076	0.076	0.076
x	0	0	0	0	0	0	0	0	0

μ=0.990

	λ=0.25			λ=0.50			λ=0.75		
x/c	J=0.25	J=0.50	J=0.75	J=0.25	J=0.50	J=0.75	J=0.25	J=0.50	J=0.75
-0.5	-0.177	-0.192	-0.205	-0.171	-0.181	-0.188	-0.155	-0.160	-0.165
-0.4	-0.166	-0.183	-0.198	-0.178	-0.192	-0.204	-0.174	-0.184	-0.193
-0.3	-0.115	-0.129	-0.143	-0.150	-0.167	-0.183	-0.166	-0.183	-0.198
-0.2	0.115	0.129	0.143	0.150	0.167	0.183	0.166	0.183	0.198
-0.1	0.166	0.183	0.198	0.178	0.192	0.204	0.174	0.184	0.193
0	0.177	0.192	0.205	0.171	0.181	0.188	0.155	0.160	0.165
0.1	0.177	0.190	0.201	0.158	0.165	0.169	0.135	0.138	0.140
0.2	0.174	0.184	0.193	0.145	0.149	0.152	0.118	0.119	0.120
0.3	0.168	0.177	0.183	0.132	0.134	0.136	0.103	0.103	0.103
0.4	0.161	0.169	0.174	0.120	0.122	0.123	0.090	0.090	0.090
0.5	0.155	0.160	0.165	0.110	0.111	0.111	0.079	0.079	0.079
x	0	0	0	0	0	0	0	0	0

N= 4
e = 0.990
χ = -0.25

TABLE 11.2

DIRECT PROPELLER CONTRIBUTION TO SHROUD SURFACE PRESSURE COEFFICIENT c_{Γ}, (x/c)

μ=0.900

	λ=0.25			λ=0.50			λ=0.75		
x/c	J=0.25	J=0.50	J=0.75	J=0.25	J=0.50	J=0.75	J=0.25	J=0.50	J=0.75
-0.5	-0.096	-0.102	-0.108	-0.119	-0.125	-0.129	-0.118	-0.121	-0.124
-0.4	-0.069	-0.074	-0.079	-0.104	-0.111	-0.116	-0.117	-0.123	-0.128
-0.3	-0.026	-0.028	-0.030	-0.050	-0.054	-0.057	-0.069	-0.074	-0.079
-0.2	0.026	0.028	0.030	0.050	0.054	0.057	0.069	0.074	0.079
-0.1	0.069	0.074	0.079	0.104	0.111	0.116	0.117	0.123	0.128
0	0.096	0.102	0.108	0.110	0.125	0.129	0.118	0.121	0.124
0.1	0.110	0.117	0.122	0.119	0.123	0.126	0.108	0.110	0.111
0.2	0.117	0.123	0.128	0.113	0.116	0.118	0.096	0.097	0.097
0.3	0.120	0.125	0.129	0.106	0.107	0.109	0.085	0.085	0.085
0.4	0.119	0.124	0.127	0.098	0.099	0.100	0.075	0.075	0.075
0.5	0.118	0.121	0.124	0.090	0.091	0.091	0.066	0.066	0.066
x	0	0	0	0	0	0	0	0	0

μ=0.940

	λ=0.25			λ=0.50			λ=0.75		
x/c	J=0.25	J=0.50	J=0.75	J=0.25	J=0.50	J=0.75	J=0.25	J=0.50	J=0.75
-0.5	-0.127	-0.136	-0.144	-0.141	-0.148	-0.154	-0.134	-0.138	-0.142
-0.4	-0.101	-0.108	-0.116	-0.134	-0.142	-0.150	-0.141	-0.149	-0.155
-0.3	-0.043	-0.046	-0.050	-0.077	-0.083	-0.089	-0.101	-0.108	-0.116
-0.2	0.043	0.046	0.050	0.077	0.083	0.089	0.101	0.108	0.116
-0.1	0.101	0.108	0.116	0.134	0.142	0.150	0.141	0.149	0.155
0	0.127	0.136	0.144	0.141	0.148	0.154	0.134	0.138	0.142
0.1	0.138	0.146	0.154	0.136	0.141	0.145	0.120	0.122	0.124
0.2	0.141	0.149	0.155	0.127	0.130	0.133	0.105	0.106	0.107
0.3	0.141	0.147	0.152	0.117	0.119	0.121	0.093	0.093	0.093
0.4	0.138	0.143	0.147	0.108	0.109	0.110	0.081	0.081	0.081
0.5	0.134	0.138	0.142	0.099	0.099	0.100	0.072	0.072	0.071
x	0	0	0	0	0	0	0	0	0

μ=0.970

	λ=0.25			λ=0.50			λ=0.75		
x/c	J=0.25	J=0.50	J=0.75	J=0.25	J=0.50	J=0.75	J=0.25	J=0.50	J=0.75
-0.5	-0.157	-0.168	-0.179	-0.160	-0.168	-0.174	-0.147	-0.152	-0.155
-0.4	-0.137	-0.149	-0.160	-0.161	-0.172	-0.181	-0.161	-0.170	-0.177
-0.3	-0.072	-0.079	-0.086	-0.115	-0.125	-0.135	-0.137	-0.149	-0.160
-0.2	0.072	0.079	0.086	0.115	0.125	0.135	0.137	0.149	0.160
-0.1	0.137	0.149	0.160	0.161	0.172	0.181	0.161	0.170	0.177
0	0.157	0.168	0.179	0.160	0.168	0.174	0.147	0.152	0.155
0.1	0.162	0.172	0.181	0.150	0.155	0.159	0.129	0.132	0.133
0.2	0.161	0.170	0.177	0.138	0.141	0.144	0.113	0.114	0.115
0.3	0.158	0.165	0.171	0.126	0.128	0.130	0.099	0.099	0.099
0.4	0.152	0.159	0.163	0.115	0.117	0.117	0.086	0.086	0.086
0.5	0.147	0.152	0.155	0.105	0.106	0.107	0.076	0.076	0.076
x	0	0	0	0	0	0	0	0	0

μ=0.990

	λ=0.25			λ=0.50			λ=0.75		
x/c	J=0.25	J=0.50	J=0.75	J=0.25	J=0.50	J=0.75	J=0.25	J=0.50	J=0.75
-0.5	-0.180	-0.194	-0.206	-0.173	-0.182	-0.189	-0.156	-0.161	-0.165
-0.4	-0.170	-0.185	-0.199	-0.181	-0.193	-0.205	-0.175	-0.185	-0.193
-0.3	-0.119	-0.131	-0.144	-0.154	-0.169	-0.184	-0.170	-0.185	-0.199
-0.2	0.119	0.131	0.144	0.154	0.169	0.184	0.170	0.185	0.199
-0.1	0.170	0.185	0.199	0.181	0.193	0.205	0.175	0.185	0.193
0	0.180	0.194	0.206	0.173	0.182	0.189	0.156	0.161	0.165
0.1	0.180	0.191	0.202	0.159	0.165	0.170	0.135	0.138	0.140
0.2	0.175	0.185	0.193	0.145	0.149	0.152	0.118	0.119	0.120
0.3	0.169	0.178	0.184	0.132	0.135	0.136	0.103	0.103	0.103
0.4	0.163	0.169	0.174	0.121	0.122	0.123	0.090	0.090	0.090
0.5	0.156	0.161	0.165	0.110	0.111	0.111	0.079	0.079	0.079
x	0	0	0	0	0	0	0	0	0

N= 6
e = 0.990
x = -0.25

TABLE 11.3

DIRECT PROPELLER CONTRIBUTION TO SHROUD SURFACE PRESSURE COEFFICIENT c_{Γ}, (x/c)

μ=0.900

	λ=0.25			λ=0.50			λ=0.75		
x/c	J=0.25	J=0.50	J=0.75	J=0.25	J=0.50	J=0.75	J=0.25	J=0.50	J=0.75
-0.5	-0.098	-0.104	-0.109	-0.121	-0.126	-0.130	-0.119	-0.122	-0.125
-0.4	-0.071	-0.075	-0.080	-0.107	-0.112	-0.117	-0.119	-0.124	-0.129
-0.3	-0.027	-0.029	-0.030	-0.051	-0.054	-0.058	-0.071	-0.075	-0.080
-0.2	0.027	0.029	0.030	0.051	0.054	0.058	0.071	0.075	0.080
-0.1	0.071	0.075	0.080	0.107	0.112	0.117	0.119	0.124	0.129
0	0.098	0.104	0.109	0.121	0.126	0.130	0.119	0.122	0.125
0.1	0.113	0.118	0.123	0.120	0.124	0.127	0.108	0.110	0.111
0.2	0.119	0.124	0.129	0.114	0.116	0.118	0.096	0.097	0.098
0.3	0.121	0.126	0.130	0.106	0.108	0.109	0.085	0.085	0.085
0.4	0.121	0.125	0.128	0.098	0.099	0.100	0.075	0.075	0.075
0.5	0.119	0.122	0.125	0.090	0.091	0.091	0.066	0.066	0.066
x	0	0	0	0	0	0	0	0	0

μ=0.940

	λ=0.25			λ=0.50			λ=0.75		
x/c	J=0.25	J=0.50	J=0.75	J=0.25	J=0.50	J=0.75	J=0.25	J=0.50	J=0.75
-0.5	-0.130	-0.138	-0.145	-0.144	-0.150	-0.155	-0.135	-0.139	-0.142
-0.4	-0.104	-0.111	-0.118	-0.137	-0.144	-0.152	-0.144	-0.150	-0.156
-0.3	-0.044	-0.047	-0.051	-0.079	-0.085	-0.090	-0.104	-0.111	-0.118
-0.2	0.044	0.047	0.051	0.079	0.085	0.090	0.104	0.111	0.118
-0.1	0.104	0.111	0.118	0.137	0.144	0.152	0.144	0.150	0.156
0	0.130	0.138	0.145	0.144	0.150	0.155	0.135	0.139	0.142
0.1	0.141	0.148	0.155	0.137	0.142	0.145	0.120	0.122	0.124
0.2	0.144	0.150	0.156	0.128	0.131	0.133	0.106	0.107	0.107
0.3	0.143	0.148	0.153	0.118	0.120	0.121	0.093	0.093	0.093
0.4	0.139	0.144	0.148	0.108	0.109	0.110	0.081	0.081	0.081
0.5	0.135	0.139	0.142	0.099	0.100	0.100	0.072	0.072	0.071
x	0	0	0	0	0	0	0	0	0

μ=0.970

	λ=0.25			λ=0.50			λ=0.75		
x/c	J=0.25	J=0.50	J=0.75	J=0.25	J=0.50	J=0.75	J=0.25	J=0.50	J=0.75
-0.5	-0.161	-0.171	-0.181	-0.162	-0.170	-0.176	-0.148	-0.153	-0.156
-0.4	-0.142	-0.152	-0.162	-0.165	-0.174	-0.183	-0.164	-0.172	-0.179
-0.3	-0.075	-0.081	-0.087	-0.119	-0.128	-0.137	-0.142	-0.152	-0.162
-0.2	0.075	0.081	0.087	0.119	0.128	0.137	0.142	0.152	0.162
-0.1	0.142	0.152	0.162	0.165	0.174	0.183	0.164	0.172	0.179
0	0.161	0.171	0.181	0.162	0.170	0.176	0.148	0.153	0.156
0.1	0.166	0.175	0.183	0.151	0.156	0.160	0.130	0.132	0.134
0.2	0.164	0.172	0.179	0.139	0.142	0.144	0.113	0.114	0.115
0.3	0.160	0.166	0.172	0.127	0.129	0.130	0.099	0.099	0.099
0.4	0.154	0.160	0.164	0.116	0.117	0.118	0.086	0.086	0.086
0.5	0.148	0.153	0.156	0.106	0.106	0.107	0.076	0.076	0.076
x	0	0	0	0	0	0	0	0	0

μ=0.990

	λ=0.25			λ=0.50			λ=0.75		
x/c	J=0.25	J=0.50	J=0.75	J=0.25	J=0.50	J=0.75	J=0.25	J=0.50	J=0.75
-0.5	-0.185	-0.197	-0.208	-0.175	-0.183	-0.190	-0.157	-0.162	-0.166
-0.4	-0.176	-0.189	-0.202	-0.185	-0.196	-0.207	-0.179	-0.187	-0.195
-0.3	-0.125	-0.135	-0.147	-0.161	-0.173	-0.187	-0.176	-0.189	-0.202
-0.2	0.125	0.135	0.147	0.161	0.173	0.187	0.176	0.189	0.202
-0.1	0.176	0.189	0.202	0.185	0.196	0.207	0.179	0.187	0.195
0	0.185	0.197	0.208	0.175	0.183	0.190	0.157	0.162	0.166
0.1	0.184	0.194	0.203	0.161	0.166	0.170	0.136	0.139	0.140
0.2	0.179	0.187	0.195	0.146	0.150	0.152	0.118	0.119	0.120
0.3	0.172	0.179	0.185	0.133	0.135	0.136	0.103	0.103	0.103
0.4	0.165	0.170	0.175	0.121	0.122	0.123	0.090	0.090	0.090
0.5	0.157	0.162	0.166	0.110	0.111	0.111	0.079	0.079	0.079
x	0	0	0	0	0	0	0	0	0

N = 3
e = 0.992
χ = -0.25

TABLE 11.4

DIRECT PROPELLER CONTRIBUTION TO SHROUD SURFACE PRESSURE COEFFICIENT c_{Γ}, (x/c)

μ=0.900

	λ=0.25			λ=0.50			λ=0.75		
x/c	J=0.25	J=0.50	J=0.75	J=0.25	J=0.50	J=0.75	J=0.25	J=0.50	J=0.75
-0.5	-0.095	-0.102	-0.108	-0.118	-0.124	-0.129	-0.117	-0.121	-0.124
-0.4	-0.069	-0.074	-0.079	-0.104	-0.111	-0.116	-0.117	-0.123	-0.128
-0.3	-0.026	-0.028	-0.030	-0.049	-0.054	-0.057	-0.069	-0.074	-0.079
-0.2	0.026	0.028	0.030	0.049	0.054	0.057	0.069	0.074	0.079
-0.1	0.069	0.074	0.079	0.104	0.111	0.116	0.117	0.123	0.128
0	0.095	0.102	0.108	0.118	0.124	0.129	0.117	0.121	0.124
0.1	0.110	0.117	0.122	0.118	0.123	0.126	0.107	0.109	0.111
0.2	0.117	0.123	0.128	0.113	0.116	0.118	0.096	0.097	0.097
0.3	0.119	0.125	0.129	0.105	0.107	0.109	0.085	0.085	0.085
0.4	0.119	0.124	0.127	0.098	0.099	0.100	0.075	0.075	0.075
0.5	0.117	0.121	0.124	0.090	0.091	0.091	0.066	0.066	0.066
x	0	0	0	0	0	0	0	0	0

μ=0.940

	λ=0.25			λ=0.50			λ=0.75		
x/c	J=0.25	J=0.50	J=0.75	J=0.25	J=0.50	J=0.75	J=0.25	J=0.50	J=0.75
-0.5	-0.126	-0.136	-0.144	-0.140	-0.148	-0.154	-0.133	-0.138	-0.142
-0.4	-0.100	-0.109	-0.117	-0.133	-0.142	-0.151	-0.140	-0.149	-0.155
-0.3	-0.042	-0.047	-0.050	-0.076	-0.083	-0.090	-0.100	-0.109	-0.117
-0.2	0.042	0.047	0.050	0.076	0.083	0.090	0.100	0.109	0.117
-0.1	0.100	0.109	0.117	0.133	0.142	0.151	0.140	0.149	0.155
0	0.126	0.136	0.144	0.140	0.148	0.154	0.133	0.138	0.142
0.1	0.137	0.146	0.154	0.135	0.141	0.145	0.119	0.122	0.124
0.2	0.140	0.149	0.155	0.127	0.130	0.133	0.105	0.106	0.107
0.3	0.140	0.147	0.152	0.117	0.119	0.121	0.093	0.093	0.093
0.4	0.137	0.143	0.147	0.108	0.109	0.110	0.081	0.081	0.081
0.5	0.133	0.138	0.142	0.099	0.099	0.100	0.072	0.072	0.071
x	0	0	0	0	0	0	0	0	0

μ=0.970

	λ=0.25			λ=0.50			λ=0.75		
x/c	J=0.25	J=0.50	J=0.75	J=0.25	J=0.50	J=0.75	J=0.25	J=0.50	J=0.75
-0.5	-0.155	-0.168	-0.180	-0.159	-0.168	-0.175	-0.146	-0.152	-0.155
-0.4	-0.136	-0.149	-0.161	-0.159	-0.171	-0.182	-0.160	-0.170	-0.178
-0.3	-0.071	-0.079	-0.087	-0.113	-0.125	-0.136	-0.136	-0.149	-0.161
-0.2	0.071	0.079	0.087	0.113	0.125	0.136	0.136	0.149	0.161
-0.1	0.136	0.149	0.161	0.159	0.171	0.182	0.160	0.170	0.178
0	0.155	0.168	0.180	0.159	0.168	0.175	0.146	0.152	0.155
0.1	0.161	0.172	0.182	0.149	0.155	0.159	0.129	0.131	0.133
0.2	0.160	0.170	0.178	0.137	0.141	0.144	0.113	0.114	0.115
0.3	0.157	0.165	0.171	0.126	0.128	0.130	0.099	0.099	0.099
0.4	0.152	0.158	0.163	0.115	0.117	0.117	0.086	0.086	0.086
0.5	0.146	0.152	0.155	0.105	0.106	0.107	0.076	0.076	0.076
x	0	0	0	0	0	0	0	0	0

μ=0.992

	λ=0.25			λ=0.50			λ=0.75		
x/c	J=0.25	J=0.50	J=0.75	J=0.25	J=0.50	J=0.75	J=0.25	J=0.50	J=0.75
-0.5	-0.181	-0.196	-0.210	-0.173	-0.183	-0.190	-0.156	-0.162	-0.166
-0.4	-0.171	-0.189	-0.205	-0.181	-0.195	-0.207	-0.176	-0.187	-0.195
-0.3	-0.125	-0.140	-0.155	-0.157	-0.175	-0.191	-0.171	-0.189	-0.205
-0.2	0.125	0.140	0.155	0.157	0.175	0.191	0.171	0.189	0.205
-0.1	0.171	0.189	0.205	0.181	0.195	0.207	0.176	0.187	0.195
0	0.181	0.196	0.210	0.173	0.183	0.190	0.156	0.162	0.166
0.1	0.180	0.193	0.204	0.159	0.166	0.171	0.136	0.139	0.141
0.2	0.176	0.187	0.195	0.146	0.150	0.153	0.118	0.119	0.120
0.3	0.170	0.179	0.185	0.133	0.135	0.137	0.103	0.103	0.104
0.4	0.163	0.170	0.175	0.121	0.122	0.123	0.090	0.090	0.090
0.5	0.156	0.162	0.166	0.110	0.111	0.111	0.079	0.079	0.079
x	0	0	0	0	0	0	0	0	0

TABLE 11.5

DIRECT PROPELLER CONTRIBUTION TO SHROUD SURFACE PRESSURE COEFFICIENT $c_{\Gamma}, (x/c)$

μ=0.900

	λ=0.25			λ=0.50			λ=0.75		
x/c	J=0.25	J=0.50	J=0.75	J=0.25	J=0.50	J=0.75	J=0.25	J=0.50	J=0.75
-0.5	-0.096	-0.103	-0.108	-0.119	-0.125	-0.130	-0.118	-0.122	-0.124
-0.4	-0.070	-0.075	-0.079	-0.105	-0.111	-0.117	-0.118	-0.124	-0.129
-0.3	-0.026	-0.028	-0.030	-0.050	-0.054	-0.057	-0.070	-0.075	-0.079
-0.2	0.026	0.028	0.030	0.050	0.054	0.057	0.070	0.075	0.079
-0.1	0.070	0.075	0.079	0.105	0.111	0.117	0.118	0.124	0.129
0	0.096	0.103	0.108	0.119	0.125	0.130	0.118	0.122	0.124
0.1	0.111	0.117	0.123	0.119	0.123	0.126	0.108	0.110	0.111
0.2	0.118	0.124	0.129	0.113	0.116	0.118	0.096	0.097	0.098
0.3	0.120	0.125	0.130	0.106	0.108	0.109	0.085	0.085	0.085
0.4	0.120	0.124	0.128	0.098	0.099	0.100	0.075	0.075	0.075
0.5	0.118	0.122	0.124	0.090	0.091	0.091	0.066	0.066	0.066
x	0	0	0	0	0	0	0	0	0

μ=0.940

	λ=0.25			λ=0.50			λ=0.75		
x/c	J=0.25	J=0.50	J=0.75	J=0.25	J=0.50	J=0.75	J=0.25	J=0.50	J=0.75
-0.5	-0.128	-0.137	-0.145	-0.142	-0.149	-0.155	-0.134	-0.139	-0.142
-0.4	-0.101	-0.110	-0.117	-0.134	-0.143	-0.151	-0.142	-0.149	-0.156
-0.3	-0.043	-0.047	-0.051	-0.077	-0.084	-0.090	-0.101	-0.110	-0.117
-0.2	0.043	0.047	0.051	0.077	0.084	0.090	0.101	0.110	0.117
-0.1	0.101	0.110	0.117	0.134	0.143	0.151	0.142	0.149	0.156
0	0.128	0.137	0.145	0.142	0.149	0.155	0.134	0.139	0.142
0.1	0.138	0.147	0.154	0.136	0.141	0.145	0.120	0.122	0.124
0.2	0.142	0.149	0.156	0.127	0.130	0.133	0.105	0.106	0.107
0.3	0.141	0.147	0.153	0.117	0.119	0.121	0.093	0.093	0.093
0.4	0.138	0.143	0.148	0.108	0.109	0.110	0.081	0.081	0.081
0.5	0.134	0.139	0.142	0.099	0.099	0.100	0.072	0.072	0.071
x	0	0	0	0	0	0	0	0	0

μ=0.970

	λ=0.25			λ=0.50			λ=0.75		
x/c	J=0.25	J=0.50	J=0.75	J=0.25	J=0.50	J=0.75	J=0.25	J=0.50	J=0.75
-0.5	-0.158	-0.170	-0.180	-0.160	-0.168	-0.175	-0.147	-0.152	-0.156
-0.4	-0.139	-0.151	-0.162	-0.161	-0.173	-0.183	-0.162	-0.171	-0.178
-0.3	-0.073	-0.080	-0.087	-0.116	-0.127	-0.137	-0.139	-0.151	-0.162
-0.2	0.073	0.080	0.087	0.116	0.127	0.137	0.139	0.151	0.162
-0.1	0.139	0.151	0.162	0.161	0.173	0.183	0.162	0.171	0.178
0	0.158	0.170	0.180	0.160	0.168	0.175	0.147	0.152	0.156
0.1	0.163	0.173	0.182	0.150	0.156	0.160	0.129	0.132	0.133
0.2	0.162	0.171	0.178	0.138	0.142	0.144	0.113	0.114	0.115
0.3	0.158	0.165	0.171	0.126	0.129	0.130	0.099	0.099	0.099
0.4	0.153	0.159	0.164	0.115	0.117	0.118	0.086	0.086	0.086
0.5	0.147	0.152	0.156	0.105	0.106	0.107	0.076	0.076	0.076
x	0	0	0	0	0	0	0	0	0

μ=0.992

	λ=0.25			λ=0.50			λ=0.75		
x/c	J=0.25	J=0.50	J=0.75	J=0.25	J=0.50	J=0.75	J=0.25	J=0.50	J=0.75
-0.5	-0.184	-0.198	-0.211	-0.175	-0.184	-0.191	-0.162	-0.157	-0.166
-0.4	-0.175	-0.191	-0.206	-0.184	-0.197	-0.208	-0.188	-0.178	-0.196
-0.3	-0.128	-0.142	-0.156	-0.161	-0.177	-0.192	-0.191	-0.175	-0.206
-0.2	0.128	0.142	0.156	0.161	0.177	0.192	0.191	0.175	0.206
-0.1	0.175	0.191	0.206	0.184	0.197	0.208	0.188	0.178	0.196
0	0.184	0.198	0.211	0.175	0.184	0.191	0.162	0.157	0.166
0.1	0.182	0.194	0.205	0.160	0.166	0.171	0.139	0.136	0.141
0.2	0.178	0.188	0.196	0.146	0.150	0.153	0.119	0.118	0.120
0.3	0.171	0.179	0.186	0.133	0.135	0.137	0.103	0.103	0.104
0.4	0.164	0.171	0.176	0.121	0.122	0.123	0.090	0.090	0.020
0.5	0.157	0.162	0.166	0.110	0.111	0.112	0.079	0.079	0.079
x	0	0	0	0	0	0	0	0	0

N= 4
e = 0.992
x = -0.25

N= 6
e = 0.992
χ = -0.25

TABLE 11.6

DIRECT PROPELLER CONTRIBUTION TO SHROUD SURFACE PRESSURE COEFFICIENT c_Γ, (x/c)

μ=0.900

	λ=0.25			λ=0.50			λ=0.75		
x/c	J=0.25	J=0.50	J=0.75	J=0.25	J=0.50	J=0.75	J=0.25	J=0.50	J=0.75
-0.5	-0.099	-0.104	-0.109	-0.121	-0.126	-0.130	-0.119	-0.122	-0.125
-0.4	-0.072	-0.076	-0.080	-0.107	-0.113	-0.118	-0.119	-0.125	-0.129
-0.3	-0.027	-0.029	-0.031	-0.052	-0.055	-0.058	-0.072	-0.076	-0.080
-0.2	0.027	0.029	0.031	0.052	0.055	0.058	0.072	0.076	0.080
-0.1	0.072	0.076	0.080	0.107	0.113	0.118	0.119	0.125	0.129
0	0.099	0.104	0.109	0.121	0.126	0.130	0.119	0.122	0.125
0.1	0.113	0.119	0.124	0.120	0.124	0.127	0.108	0.110	0.111
0.2	0.119	0.125	0.129	0.114	0.116	0.118	0.096	0.097	0.098
0.3	0.122	0.126	0.130	0.106	0.108	0.109	0.085	0.085	0.085
0.4	0.121	0.125	0.128	0.098	0.099	0.100	0.075	0.075	0.075
0.5	0.119	0.122	0.125	0.090	0.091	0.091	0.066	0.066	0.066
x	0	0	0	0	0	0	0	0	0

μ=0.940

	λ=0.25			λ=0.50			λ=0.75		
x/c	J=0.25	J=0.50	J=0.75	J=0.25	J=0.50	J=0.75	J=0.25	J=0.50	J=0.75
-0.5	-0.131	-0.139	-0.146	-0.144	-0.150	-0.156	-0.135	-0.139	-0.142
-0.4	-0.105	-0.112	-0.119	-0.137	-0.145	-0.153	-0.144	-0.151	-0.157
-0.3	-0.045	-0.048	-0.051	-0.080	-0.086	-0.091	-0.105	-0.112	-0.119
-0.2	0.045	0.048	0.051	0.080	0.086	0.091	0.105	0.112	0.119
-0.1	0.105	0.112	0.119	0.137	0.145	0.153	0.144	0.151	0.157
0	0.131	0.139	0.146	0.144	0.150	0.156	0.135	0.139	0.142
0.1	0.141	0.149	0.156	0.137	0.142	0.146	0.120	0.122	0.124
0.2	0.144	0.151	0.157	0.128	0.131	0.133	0.106	0.107	0.107
0.3	0.143	0.149	0.154	0.118	0.120	0.121	0.093	0.093	0.093
0.4	0.140	0.144	0.148	0.108	0.109	0.110	0.081	0.081	0.081
0.5	0.135	0.139	0.142	0.099	0.100	0.100	0.072	0.072	0.071
x	0	0	0	0	0	0	0	0	0

μ=0.970

	λ=0.25			λ=0.50			λ=0.75		
x/c	J=0.25	J=0.50	J=0.75	J=0.25	J=0.50	J=0.75	J=0.25	J=0.50	J=0.75
-0.5	-0.162	-0.172	-0.182	-0.163	-0.170	-0.176	-0.148	-0.153	-0.156
-0.4	-0.143	-0.154	-0.164	-0.165	-0.175	-0.184	-0.165	-0.173	-0.180
-0.3	-0.076	-0.082	-0.089	-0.120	-0.129	-0.139	-0.143	-0.154	-0.164
-0.2	0.076	0.082	0.089	0.120	0.129	0.139	0.143	0.154	0.164
-0.1	0.143	0.154	0.164	0.165	0.175	0.184	0.165	0.173	0.180
0	0.162	0.172	0.182	0.163	0.170	0.176	0.148	0.153	0.156
0.1	0.166	0.176	0.184	0.151	0.157	0.160	0.130	0.132	0.134
0.2	0.165	0.173	0.180	0.139	0.142	0.145	0.113	0.114	0.115
0.3	0.160	0.167	0.172	0.127	0.129	0.130	0.099	0.099	0.099
0.4	0.154	0.160	0.164	0.116	0.117	0.118	0.086	0.086	0.086
0.5	0.148	0.153	0.156	0.106	0.106	0.107	0.076	0.076	0.076
x	0	0	0	0	0	0	0	0	0

μ=0.992

	λ=0.25			λ=0.50			λ=0.75		
x/c	J=0.25	J=0.50	J=0.75	J=0.25	J=0.50	J=0.75	J=0.25	J=0.50	J=0.75
-0.5	-0.189	-0.201	-0.213	-0.177	-0.185	-0.192	-0.158	-0.163	-0.167
-0.4	-0.181	-0.195	-0.209	-0.188	-0.200	-0.210	-0.181	-0.190	-0.197
-0.3	-0.134	-0.145	-0.159	-0.168	-0.181	-0.195	-0.181	-0.195	-0.209
-0.2	0.134	0.145	0.159	0.168	0.181	0.195	0.181	0.195	0.209
-0.1	0.181	0.195	0.209	0.188	0.200	0.210	0.181	0.190	0.197
0	0.189	0.201	0.213	0.177	0.185	0.192	0.158	0.163	0.167
0.1	0.186	0.197	0.207	0.162	0.168	0.172	0.137	0.139	0.141
0.2	0.181	0.190	0.197	0.147	0.151	0.153	0.119	0.120	0.120
0.3	0.173	0.181	0.187	0.134	0.136	0.137	0.103	0.104	0.104
0.4	0.166	0.172	0.177	0.121	0.123	0.123	0.090	0.090	0.090
0.5	0.158	0.163	0.167	0.110	0.111	0.112	0.079	0.079	0.079
x	0	0	0	0	0	0	0	0	0

N = 3
e = 0.994
χ = -0.25

TABLE 11.7

DIRECT PROPELLER CONTRIBUTION TO SHROUD SURFACE PRESSURE COEFFICIENT c_{Γ}, (x/c)

μ=0.900

	λ=0.25			λ=0.50			λ=0.75		
x/c	J=0.25	J=0.50	J=0.75	J=0.25	J=0.50	J=0.75	J=0.25	J=0.50	J=0.75
-0.5	-0.096	-0.103	-0.109	-0.119	-0.125	-0.130	-0.117	-0.122	-0.125
-0.4	-0.069	-0.075	-0.080	-0.104	-0.111	-0.117	-0.117	-0.124	-0.129
-0.3	-0.026	-0.029	-0.031	-0.050	-0.054	-0.058	-0.069	-0.075	-0.080
-0.2	0.026	0.029	0.031	0.050	0.054	0.058	0.069	0.075	0.080
-0.1	0.069	0.075	0.080	0.104	0.111	0.117	0.117	0.124	0.129
0	0.096	0.103	0.109	0.119	0.125	0.130	0.117	0.122	0.125
0.1	0.110	0.117	0.123	0.118	0.123	0.126	0.107	0.110	0.111
0.2	0.117	0.124	0.129	0.113	0.116	0.118	0.096	0.097	0.098
0.3	0.119	0.125	0.130	0.106	0.107	0.109	0.085	0.085	0.085
0.4	0.119	0.124	0.128	0.098	0.099	0.100	0.075	0.075	0.075
0.5	0.117	0.122	0.125	0.090	0.091	0.091	0.066	0.066	0.066
x	0	0	0	0	0	0	0	0	0

μ=0.940

	λ=0.25			λ=0.50			λ=0.75		
x/c	J=0.25	J=0.50	J=0.75	J=0.25	J=0.50	J=0.75	J=0.25	J=0.50	J=0.75
-0.5	-0.127	-0.137	-0.146	-0.141	-0.149	-0.155	-0.134	-0.139	-0.142
-0.4	-0.101	-0.110	-0.118	-0.133	-0.144	-0.152	-0.141	-0.149	-0.156
-0.3	-0.043	-0.047	-0.051	-0.077	-0.084	-0.091	-0.101	-0.110	-0.118
-0.2	0.043	0.047	0.051	0.077	0.084	0.091	0.101	0.110	0.118
-0.1	0.101	0.110	0.118	0.133	0.144	0.152	0.141	0.149	0.156
0	0.127	0.137	0.146	0.141	0.149	0.155	0.134	0.139	0.142
0.1	0.138	0.147	0.155	0.136	0.141	0.145	0.120	0.122	0.124
0.2	0.141	0.149	0.156	0.127	0.130	0.133	0.105	0.106	0.107
0.3	0.140	0.147	0.153	0.117	0.119	0.121	0.093	0.093	0.093
0.4	0.137	0.143	0.148	0.108	0.109	0.110	0.081	0.081	0.081
0.5	0.134	0.139	0.142	0.099	0.099	0.100	0.072	0.072	0.071
x	0	0	0	0	0	0	0	0	0

μ=0.970

	λ=0.25			λ=0.50			λ=0.75		
x/c	J=0.25	J=0.50	J=0.75	J=0.25	J=0.50	J=0.75	J=0.25	J=0.50	J=0.75
-0.5	-0.157	-0.170	-0.181	-0.159	-0.168	-0.175	-0.147	-0.152	-0.156
-0.4	-0.138	-0.151	-0.163	-0.160	-0.173	-0.183	-0.161	-0.171	-0.179
-0.3	-0.073	-0.081	-0.089	-0.115	-0.128	-0.139	-0.138	-0.151	-0.163
-0.2	0.073	0.081	0.089	0.115	0.128	0.139	0.138	0.151	0.163
-0.1	0.138	0.151	0.163	0.160	0.173	0.183	0.161	0.171	0.179
0	0.157	0.170	0.181	0.159	0.168	0.175	0.147	0.152	0.156
0.1	0.162	0.174	0.183	0.149	0.155	0.160	0.129	0.132	0.133
0.2	0.161	0.171	0.179	0.138	0.142	0.144	0.113	0.114	0.115
0.3	0.157	0.165	0.172	0.126	0.128	0.130	0.099	0.099	0.099
0.4	0.152	0.159	0.164	0.115	0.117	0.118	0.086	0.086	0.086
0.5	0.147	0.152	0.156	0.105	0.106	0.107	0.076	0.076	0.076
x	0	0	0	0	0	0	0	0	0

μ=0.994

	λ=0.25			λ=0.50			λ=0.75		
x/c	J=0.25	J=0.50	J=0.75	J=0.25	J=0.50	J=0.75	J=0.25	J=0.50	J=0.75
-0.5	-0.185	-0.201	-0.215	-0.175	-0.185	-0.193	-0.157	-0.163	-0.167
-0.4	-0.177	-0.196	-0.212	-0.184	-0.199	-0.212	-0.178	-0.189	-0.198
-0.3	-0.136	-0.153	-0.169	-0.165	-0.184	-0.201	-0.177	-0.196	-0.212
-0.2	0.136	0.153	0.169	0.165	0.184	0.201	0.177	0.196	0.212
-0.1	0.177	0.196	0.212	0.184	0.199	0.212	0.178	0.189	0.198
0	0.185	0.201	0.215	0.175	0.185	0.193	0.157	0.163	0.167
0.1	0.183	0.197	0.208	0.161	0.167	0.172	0.137	0.139	0.141
0.2	0.178	0.189	0.198	0.147	0.151	0.154	0.119	0.120	0.121
0.3	0.171	0.181	0.187	0.133	0.136	0.138	0.103	0.104	0.104
0.4	0.164	0.172	0.177	0.121	0.123	0.124	0.091	0.091	0.090
0.5	0.157	0.163	0.167	0.111	0.112	0.112	0.080	0.079	0.079
x	0	0	0	0	0	0	0	0	0

N = 4
e = 0.994
x = -0.25

TABLE 11.8

DIRECT PROPELLER CONTRIBUTION TO SHROUD SURFACE PRESSURE COEFFICIENT c_{Γ}, (x/c)

μ=0.900

x/c	λ=0.25 J=0.25	λ=0.25 J=0.50	λ=0.25 J=0.75	λ=0.50 J=0.25	λ=0.50 J=0.50	λ=0.50 J=0.75	λ=0.75 J=0.25	λ=0.75 J=0.50	λ=0.75 J=0.75
-0.5	-0.097	-0.104	-0.109	-0.120	-0.126	-0.130	-0.118	-0.122	-0.125
-0.4	-0.070	-0.076	-0.080	-0.105	-0.112	-0.118	-0.118	-0.124	-0.129
-0.3	-0.027	-0.029	-0.031	-0.051	-0.055	-0.058	-0.070	-0.076	-0.080
-0.2	0.027	0.029	0.031	0.051	0.055	0.058	0.070	0.076	0.080
-0.1	0.070	0.076	0.080	0.105	0.112	0.118	0.118	0.121	0.129
0	0.097	0.104	0.109	0.120	0.126	0.130	0.118	0.122	0.125
0.1	0.111	0.118	0.123	0.119	0.123	0.127	0.108	0.110	0.111
0.2	0.118	0.124	0.129	0.113	0.116	0.118	0.096	0.097	0.098
0.3	0.120	0.126	0.130	0.106	0.108	0.109	0.085	0.085	0.085
0.4	0.120	0.125	0.128	0.098	0.099	0.100	0.075	0.075	0.075
0.5	0.118	0.122	0.125	0.090	0.091	0.091	0.066	0.066	0.066
x	0	0	0	0	0	0	0	0	0

μ=0.940

x/c	λ=0.25 J=0.25	λ=0.25 J=0.50	λ=0.25 J=0.75	λ=0.50 J=0.25	λ=0.50 J=0.50	λ=0.50 J=0.75	λ=0.75 J=0.25	λ=0.75 J=0.50	λ=0.75 J=0.75
-0.5	-0.129	-0.138	-0.146	-0.142	-0.149	-0.155	-0.134	-0.139	-0.142
-0.4	-0.102	-0.111	-0.119	-0.135	-0.144	-0.152	-0.142	-0.150	-0.156
-0.3	-0.044	-0.048	-0.051	-0.078	-0.085	-0.092	-0.102	-0.111	-0.119
-0.2	0.044	0.048	0.051	0.078	0.085	0.092	0.102	0.111	0.119
-0.1	0.102	0.111	0.119	0.135	0.144	0.152	0.142	0.150	0.156
0	0.129	0.138	0.146	0.142	0.149	0.155	0.134	0.139	0.142
0.1	0.139	0.148	0.156	0.136	0.142	0.145	0.120	0.122	0.124
0.2	0.142	0.150	0.156	0.127	0.131	0.133	0.105	0.107	0.107
0.3	0.141	0.148	0.153	0.117	0.119	0.121	0.093	0.093	0.093
0.4	0.138	0.144	0.148	0.108	0.109	0.110	0.081	0.081	0.081
0.5	0.134	0.139	0.142	0.099	0.099	0.100	0.072	0.072	0.071
x	0	0	0	0	0	0	0	0	0

μ=0.970

x/c	λ=0.25 J=0.25	λ=0.25 J=0.50	λ=0.25 J=0.75	λ=0.50 J=0.25	λ=0.50 J=0.50	λ=0.50 J=0.75	λ=0.75 J=0.25	λ=0.75 J=0.50	λ=0.75 J=0.75
-0.5	-0.159	-0.171	-0.182	-0.161	-0.169	-0.176	-0.147	-0.152	-0.156
-0.4	-0.140	-0.153	-0.164	-0.162	-0.174	-0.184	-0.162	-0.172	-0.179
-0.3	-0.074	-0.082	-0.089	-0.118	-0.129	-0.140	-0.140	-0.153	-0.164
-0.2	0.074	0.082	0.089	0.118	0.129	0.140	0.140	0.153	0.164
-0.1	0.140	0.153	0.164	0.162	0.174	0.184	0.162	0.172	0.179
0	0.159	0.171	0.182	0.161	0.169	0.176	0.147	0.152	0.156
0.1	0.164	0.175	0.184	0.150	0.156	0.160	0.129	0.132	0.134
0.2	0.162	0.172	0.179	0.138	0.142	0.144	0.113	0.114	0.115
0.3	0.158	0.166	0.172	0.126	0.129	0.130	0.099	0.099	0.099
0.4	0.153	0.159	0.164	0.115	0.117	0.118	0.086	0.086	0.086
0.5	0.147	0.152	0.156	0.105	0.106	0.107	0.076	0.076	0.076
x	0	0	0	0	0	0	0	0	0

μ=0.994

x/c	λ=0.25 J=0.25	λ=0.25 J=0.50	λ=0.25 J=0.75	λ=0.50 J=0.25	λ=0.50 J=0.50	λ=0.50 J=0.75	λ=0.75 J=0.25	λ=0.75 J=0.50	λ=0.75 J=0.75
-0.5	-0.187	-0.202	-0.216	-0.176	-0.186	-0.193	-0.158	-0.164	-0.168
-0.4	-0.181	-0.197	-0.213	-0.187	-0.201	-0.213	-0.180	-0.190	-0.199
-0.3	-0.139	-0.155	-0.170	-0.168	-0.186	-0.202	-0.181	-0.197	-0.213
-0.2	0.139	0.155	0.170	0.168	0.186	0.202	0.181	0.197	0.213
-0.1	0.181	0.197	0.213	0.187	0.201	0.213	0.180	0.190	0.199
0	0.187	0.202	0.216	0.176	0.186	0.193	0.158	0.164	0.168
0.1	0.185	0.198	0.208	0.162	0.168	0.172	0.137	0.140	0.142
0.2	0.180	0.190	0.199	0.147	0.151	0.154	0.119	0.120	0.121
0.3	0.173	0.181	0.188	0.134	0.136	0.138	0.104	0.104	0.104
0.4	0.165	0.172	0.177	0.122	0.123	0.124	0.091	0.091	0.090
0.5	0.158	0.164	0.168	0.111	0.112	0.112	0.080	0.079	0.079
x	0	0	0	0	0	0	0	0	0

N= 6
e = 0.994
χ = -0.25

TABLE 11.9

DIRECT PROPELLER CONTRIBUTION TO SHROUD SURFACE PRESSURE COEFFICIENT $c_{\Gamma}, (x/c)$

μ=0.900

	λ=0.25			λ=0.50			λ=0.75		
x/c	J=0.25	J=0.50	J=0.75	J=0.25	J=0.50	J=0.75	J=0.25	J=0.50	J=0.75
-0.5	-0.099	-0.105	-0.110	-0.121	-0.127	-0.131	-0.119	-0.123	-0.125
-0.4	-0.072	-0.077	-0.081	-0.107	-0.113	-0.119	-0.120	-0.125	-0.130
-0.3	-0.027	-0.029	-0.031	-0.052	-0.055	-0.059	-0.072	-0.077	-0.081
-0.2	0.027	0.029	0.031	0.052	0.055	0.059	0.072	0.077	0.081
-0.1	0.072	0.077	0.081	0.107	0.113	0.119	0.120	0.125	0.130
0	0.099	0.105	0.110	0.121	0.127	0.131	0.119	0.123	0.125
0.1	0.113	0.119	0.124	0.120	0.124	0.127	0.108	0.110	0.111
0.2	0.120	0.125	0.130	0.114	0.117	0.119	0.096	0.097	0.098
0.3	0.122	0.127	0.131	0.106	0.108	0.109	0.085	0.085	0.085
0.4	0.121	0.125	0.129	0.098	0.099	0.100	0.075	0.075	0.075
0.5	0.119	0.123	0.125	0.090	0.091	0.091	0.066	0.066	0.066
χ	0	0	0	0	0	0	0	0	0

μ=0.940

	λ=0.25			λ=0.50			λ=0.75		
x/c	J=0.25	J=0.50	J=0.75	J=0.25	J=0.50	J=0.75	J=0.25	J=0.50	J=0.75
-0.5	-0.132	-0.140	-0.148	-0.144	-0.151	-0.156	-0.135	-0.143	-0.140
-0.4	-0.105	-0.113	-0.120	-0.138	-0.146	-0.154	-0.144	-0.157	-0.152
-0.3	-0.045	-0.049	-0.052	-0.081	-0.087	-0.093	-0.105	-0.120	-0.113
-0.2	0.045	0.049	0.052	0.081	0.087	0.093	0.105	0.120	0.113
-0.1	0.105	0.113	0.120	0.138	0.146	0.154	0.144	0.157	0.152
0	0.132	0.140	0.148	0.144	0.151	0.156	0.135	0.143	0.140
0.1	0.142	0.150	0.157	0.138	0.142	0.146	0.120	0.124	0.123
0.2	0.144	0.152	0.157	0.128	0.131	0.133	0.106	0.107	0.107
0.3	0.143	0.149	0.154	0.118	0.120	0.121	0.093	0.093	0.093
0.4	0.140	0.145	0.149	0.108	0.109	0.110	0.081	0.081	0.081
0.5	0.135	0.140	0.143	0.099	0.100	0.100	0.072	0.071	0.072
χ	0	0	0	0	0	0	0	0	0

μ=0.970

	λ=0.25			λ=0.50			λ=0.75		
x/c	J=0.25	J=0.50	J=0.75	J=0.25	J=0.50	J=0.75	J=0.25	J=0.50	J=0.75
-0.5	-0.163	-0.174	-0.184	-0.163	-0.171	-0.177	-0.149	-0.153	-0.157
-0.4	-0.145	-0.155	-0.166	-0.166	-0.176	-0.186	-0.165	-0.173	-0.180
-0.3	-0.077	-0.084	-0.091	-0.122	-0.131	-0.141	-0.145	-0.155	-0.166
-0.2	0.077	0.084	0.091	0.122	0.131	0.141	0.145	0.155	0.166
-0.1	0.145	0.155	0.166	0.166	0.176	0.186	0.165	0.173	0.180
0	0.163	0.174	0.184	0.163	0.171	0.177	0.149	0.153	0.157
0.1	0.167	0.177	0.185	0.152	0.157	0.161	0.130	0.132	0.134
0.2	0.165	0.173	0.180	0.139	0.142	0.145	0.113	0.114	0.115
0.3	0.161	0.168	0.173	0.127	0.129	0.130	0.099	0.099	0.099
0.4	0.155	0.161	0.165	0.116	0.117	0.118	0.086	0.086	0.086
0.5	0.149	0.153	0.157	0.105	0.106	0.107	0.076	0.076	0.076
χ	0	0	0	0	0	0	0	0	0

μ=0.994

	λ=0.25			λ=0.50			λ=0.75		
x/c	J=0.25	J=0.50	J=0.75	J=0.25	J=0.50	J=0.75	J=0.25	J=0.50	J=0.75
-0.5	-0.192	-0.205	-0.218	-0.179	-0.188	-0.194	-0.159	-0.164	-0.168
-0.4	-0.187	-0.201	-0.216	-0.191	-0.204	-0.214	-0.183	-0.192	-0.200
-0.3	-0.146	-0.158	-0.173	-0.175	-0.190	-0.205	-0.187	-0.201	-0.216
-0.2	0.146	0.158	0.173	0.175	0.190	0.205	0.187	0.201	0.216
-0.1	0.187	0.201	0.216	0.191	0.204	0.214	0.183	0.192	0.200
0	0.192	0.205	0.218	0.179	0.188	0.194	0.159	0.164	0.168
0.1	0.189	0.200	0.210	0.163	0.169	0.173	0.138	0.140	0.142
0.2	0.183	0.192	0.200	0.148	0.152	0.154	0.119	0.120	0.121
0.3	0.175	0.183	0.189	0.134	0.136	0.138	0.104	0.104	0.104
0.4	0.167	0.173	0.178	0.122	0.123	0.124	0.091	0.091	0.090
0.5	0.159	0.164	0.168	0.111	0.112	0.112	0.080	0.079	0.079
χ	0	0	0	0	0	0	0	0	0

N=3
e = 0.990
x = 0.00

TABLE 11.10

DIRECT PROPELLER CONTRIBUTION TO SHROUD SURFACE PRESSURE COEFFICIENT c_{Γ}, (x/c)

μ=0.900

	λ=0.25			λ=0.50			λ=0.75		
x/c	J=0.25	J=0.50	J=0.75	J=0.25	J=0.50	J=0.75	J=0.25	J=0.50	J=0.75
-0.5	-0.118	-0.124	-0.129	-0.109	-0.111	-0.113	-0.090	-0.091	-0.091
-0.4	-0.113	-0.120	-0.125	-0.116	-0.119	-0.122	-0.101	-0.103	-0.104
-0.3	-0.103	-0.110	-0.116	-0.119	-0.124	-0.128	-0.113	-0.116	-0.118
-0.2	-0.083	-0.090	-0.095	-0.113	-0.120	-0.125	-0.119	-0.124	-0.128
-0.1	-0.049	-0.053	-0.057	-0.083	-0.090	-0.095	-0.103	-0.110	-0.116
0	0	0	0	0	0	0	0	0	0
0.1	0.049	0.053	0.057	0.083	0.090	0.095	0.103	0.110	0.116
0.2	0.083	0.090	0.095	0.113	0.120	0.125	0.119	0.124	0.128
0.3	0.103	0.110	0.116	0.119	0.124	0.128	0.113	0.116	0.118
0.4	0.113	0.120	0.125	0.116	0.119	0.122	0.101	0.103	0.104
0.5	0.118	0.124	0.129	0.109	0.111	0.113	0.090	0.091	0.091
x	0	0	0	0	0	0	0	0	0

μ=0.940

	λ=0.25			λ=0.50			λ=0.75		
x/c	J=0.25	J=0.50	J=0.75	J=0.25	J=0.50	J=0.75	J=0.25	J=0.50	J=0.75
-0.5	-0.140	-0.147	-0.153	-0.122	-0.124	-0.126	-0.099	-0.099	-0.100
-0.4	-0.138	-0.147	-0.154	-0.131	-0.135	-0.138	-0.112	-0.114	-0.115
-0.3	-0.132	-0.141	-0.150	-0.138	-0.144	-0.149	-0.126	-0.130	-0.132
-0.2	-0.1[illegible]4	-0.124	-0.133	-0.138	-0.147	-0.154	-0.138	-0.144	-0.149
-0.1	-0.075	-0.082	-0.089	-0.114	-0.124	-0.133	-0.132	-0.141	-0.150
0	0	0	0	0	0	0	0	0	0
0.1	0.075	0.082	0.089	0.114	0.124	0.133	0.132	0.141	0.150
0.2	0.114	0.124	0.133	0.138	0.147	0.154	0.138	0.138	0.149
0.3	0.132	0.141	0.150	0.138	0.144	0.149	0.126	0.130	0.132
0.4	0.138	0.147	0.154	0.131	0.135	0.138	0.112	0.114	0.115
0.5	0.140	0.147	0.153	0.122	0.124	0.126	0.099	0.099	0.100
x	0	0	0	0	0	0	0	0	0

μ=0.970

	λ=0.25			λ=0.50			λ=0.75		
x/c	J=0.25	J=0.50	J=0.75	J=0.25	J=0.50	J=0.75	J=0.25	J=0.50	J=0.75
-0.5	-0.158	-0.167	-0.174	-0.131	-0.134	-0.137	-0.105	-0.106	-0.106
-0.4	-0.160	-0.171	-0.179	-0.143	-0.148	-0.151	-0.120	-0.122	-0.123
-0.3	-0.158	-0.170	-0.181	-0.154	-0.161	-0.167	-0.137	-0.141	-0.144
-0.2	-0.147	-0.160	-0.172	-0.160	-0.171	-0.179	-0.154	-0.161	-0.167
-0.1	-0.112	-0.124	-0.134	-0.147	-0.160	-0.172	-0.158	-0.170	-0.181
0	0	0	0	0	0	0	0	0	0
0.1	0.112	0.124	0.134	0.147	0.160	0.172	0.158	0.170	0.181
0.2	0.147	0.160	0.172	0.160	0.171	0.179	0.154	0.161	0.167
0.3	0.158	0.170	0.181	0.154	0.161	0.167	0.137	0.141	0.144
0.4	0.160	0.171	0.179	0.143	0.148	0.151	0.120	0.122	0.123
0.5	0.158	0.167	0.174	0.131	0.134	0.137	0.105	0.106	0.106
x	0	0	0	0	0	0	0	0	0

μ=0.990

	λ=0.25			λ=0.50			λ=0.75		
x/c	J=0.25	J=0.50	J=0.75	J=0.25	J=0.50	J=0.75	J=0.25	J=0.50	J=0.75
-0.5	-0.171	-0.181	-0.188	-0.138	-0.141	-0.144	-0.110	-0.111	-0.111
-0.4	-0.176	-0.187	-0.197	-0.151	-0.156	-0.160	-0.126	-0.128	-0.129
-0.3	-0.178	-0.192	-0.204	-0.165	-0.173	-0.179	-0.145	-0.149	-0.152
-0.2	-0.173	-0.190	-0.204	-0.176	-0.187	-0.197	-0.165	-0.173	-0.179
-0.1	-0.150	-0.167	-0.183	-0.173	-0.190	-0.204	-0.178	-0.192	-0.204
0	0	0	0	0	0	0	0	0	0
0.1	0.150	0.167	0.183	0.173	0.190	0.204	0.178	0.192	0.204
0.2	0.173	0.190	0.204	0.176	0.187	0.197	0.165	0.173	0.179
0.3	0.178	0.192	0.204	0.165	0.173	0.179	0.145	0.149	0.152
0.4	0.176	0.187	0.197	0.151	0.156	0.160	0.126	0.128	0.129
0.5	0.171	0.181	0.188	0.138	0.141	0.144	0.110	0.111	0.111
x	0	0	0	0	0	0	0	0	0

N= 4
e = 0.990
x = 0.00

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TABLE 11.11

DIRECT PROPELLER CONTRIBUTION TO SHROUD SURFACE PRESSURE COEFFICIENT c_{Γ}, (x/c)

μ=0.900

	λ=0.25			λ=0.50			λ=0.75		
x/c	J=0.25	J=0.50	J=0.75	J=0.25	J=0.50	J=0.75	J=0.25	J=0.50	J=0.75
-0.5	-0.119	-0.125	-0.129	-0.109	-0.112	-0.113	-0.090	-0.091	-0.091
-0.4	-0.114	-0.121	-0.126	-0.116	-0.120	-0.122	-0.102	-0.103	-0.104
-0.3	-0.104	-0.111	-0.116	-0.120	-0.124	-0.128	-0.113	-0.116	-0.118
-0.2	-0.084	-0.090	-0.095	-0.114	-0.121	-0.126	-0.120	-0.124	-0.128
-0.1	-0.050	-0.054	-0.057	-0.084	-0.090	-0.095	-0.104	-0.111	-0.116
0	0	0	0	0	0	0	0	0	0
0.1	0.050	0.054	0.057	0.084	0.090	0.095	0.104	0.111	0.116
0.2	0.084	0.090	0.095	0.114	0.121	0.126	0.120	0.124	0.128
0.3	0.104	0.111	0.116	0.120	0.124	0.128	0.113	0.116	0.118
0.4	0.114	0.121	0.126	0.116	0.120	0.122	0.102	0.103	0.104
0.5	0.119	0.125	0.129	0.109	0.112	0.113	0.090	0.091	0.091
x	0	0	0	0	0	0	0	0	0

μ=0.940

	λ=0.25			λ=0.50			λ=0.75		
x/c	J=0.25	J=0.50	J=0.75	J=0.25	J=0.50	J=0.75	J=0.25	J=0.50	J=0.75
-0.5	-0.141	-0.148	-0.154	-0.122	-0.125	-0.126	-0.099	-0.099	-0.100
-0.4	-0.140	-0.148	-0.155	-0.132	-0.136	-0.139	-0.112	-0.114	-0.115
-0.3	-0.134	-0.142	-0.150	-0.139	-0.145	-0.150	-0.127	-0.130	-0.133
-0.2	-0.116	-0.125	-0.133	-0.140	-0.148	-0.155	-0.139	-0.145	-0.150
-0.1	-0.077	-0.083	-0.089	-0.116	-0.125	-0.133	-0.134	-0.142	-0.150
0	0	0	0	0	0	0	0	0	0
0.1	0.077	0.083	0.089	0.116	0.125	0.133	0.134	0.142	0.150
0.2	0.116	0.125	0.133	0.140	0.148	0.155	0.139	0.145	0.150
0.3	0.134	0.142	0.150	0.139	0.145	0.150	0.127	0.130	0.133
0.4	0.140	0.148	0.155	0.132	0.136	0.139	0.112	0.114	0.115
0.5	0.141	0.148	0.154	0.122	0.125	0.126	0.099	0.099	0.100
x	0	0	0	0	0	0	0	0	0

μ=0.970

	λ=0.25			λ=0.50			λ=0.75		
x/c	J=0.25	J=0.50	J=0.75	J=0.25	J=0.50	J=0.75	J=0.25	J=0.50	J=0.75
-0.5	-0.160	-0.168	-0.174	-0.132	-0.135	-0.137	-0.105	-0.106	-0.107
-0.4	-0.162	-0.172	-0.180	-0.144	-0.148	-0.151	-0.121	-0.122	-0.123
-0.3	-0.161	-0.172	-0.181	-0.155	-0.162	-0.167	-0.138	-0.141	-0.144
-0.2	-0.150	-0.162	-0.173	-0.162	-0.172	-0.180	-0.155	-0.162	-0.167
-0.1	-0.115	-0.125	-0.135	-0.150	-0.162	-0.173	-0.161	-0.172	-0.181
0	0	0	0	0	0	0	0	0	0
0.1	0.115	0.125	0.135	0.150	0.162	0.173	0.161	0.172	0.181
0.2	0.150	0.162	0.173	0.162	0.172	0.180	0.155	0.162	0.167
0.3	0.161	0.172	0.181	0.155	0.162	0.167	0.138	0.141	0.144
0.4	0.162	0.172	0.180	0.144	0.148	0.151	0.121	0.122	0.123
0.5	0.160	0.168	0.174	0.132	0.135	0.137	0.105	0.106	0.107
x	0	0	0	0	0	0	0	0	0

μ=0.990

	λ=0.25			λ=0.50			λ=0.75		
x/c	J=0.25	J=0.50	J=0.75	J=0.25	J=0.50	J=0.75	J=0.25	J=0.50	J=0.75
-0.5	-0.173	-0.182	-0.189	-0.139	-0.142	-0.144	-0.110	-0.111	-0.111
-0.4	-0.178	-0.189	-0.198	-0.152	-0.157	-0.160	-0.126	-0.128	-0.129
-0.3	-0.181	-0.193	-0.205	-0.166	-0.173	-0.179	-0.145	-0.149	-0.152
-0.2	-0.177	-0.191	-0.205	-0.178	-0.189	-0.198	-0.166	-0.173	-0.179
-0.1	-0.154	-0.169	-0.184	-0.177	-0.191	-0.205	-0.181	-0.193	-0.205
0	0	0	0	0	0	0	0	0	0
0.1	0.154	0.169	0.184	0.177	0.191	0.205	0.181	0.193	0.205
0.2	0.177	0.191	0.205	0.178	0.189	0.198	0.166	0.173	0.179
0.3	0.181	0.193	0.205	0.166	0.173	0.179	0.145	0.149	0.152
0.4	0.178	0.189	0.198	0.152	0.157	0.160	0.126	0.128	0.129
0.5	0.173	0.182	0.189	0.139	0.142	0.144	0.110	0.111	0.111
x	0	0	0	0	0	0	0	0	0

N= 6
e = 0.990
χ = 0.00

TABLE 11.12

DIRECT PROPELLER CONTRIBUTION TO SHROUD SURFACE PRESSURE COEFFICIENT c_Γ, (x/c)

μ=0.900

	λ=0.25			λ=0.50			λ=0.75		
x/c	J=0.25	J=0.50	J=0.75	J=0.25	J=0.50	J=0.75	J=0.25	J=0.50	J=0.75
-0.5	-0.121	-0.126	-0.130	-0.110	-0.112	-0.114	-0.090	-0.091	-0.091
-0.4	-0.116	-0.122	-0.127	-0.117	-0.120	-0.123	-0.102	-0.103	-0.104
-0.3	-0.107	-0.112	-0.117	-0.121	-0.125	-0.129	-0.114	-0.116	-0.118
-0.2	-0.087	-0.092	-0.096	-0.116	-0.122	-0.127	-0.121	-0.125	-0.129
-0.1	-0.051	-0.054	-0.058	-0.087	-0.092	-0.096	-0.107	-0.112	-0.117
0	0	0	0	0	0	0	0	0	0
0.1	0.051	0.054	0.058	0.087	0.092	0.096	0.107	0.112	0.117
0.2	0.087	0.092	0.096	0.116	0.122	0.127	0.121	0.125	0.129
0.3	0.107	0.112	0.117	0.121	0.125	0.129	0.114	0.116	0.118
0.4	0.116	0.122	0.127	0.117	0.120	0.123	0.102	0.103	0.104
0.5	0.121	0.126	0.130	0.110	0.112	0.114	0.090	0.091	0.091
x	0	0	0	0	0	0	0	0	0

μ=0.940

	λ=0.25			λ=0.50			λ=0.75		
x/c	J=0.25	J=0.50	J=0.75	J=0.25	J=0.50	J=0.75	J=0.25	J=0.50	J=0.75
-0.5	-0.144	-0.150	-0.155	-0.123	-0.125	-0.127	-0.099	-0.100	-0.100
-0.4	-0.143	-0.150	-0.156	-0.133	-0.136	-0.139	-0.113	-0.114	-0.115
-0.3	-0.137	-0.144	-0.152	-0.141	-0.146	-0.151	-0.128	-0.131	-0.133
-0.2	-0.120	-0.127	-0.135	-0.143	-0.150	-0.156	-0.141	-0.146	-0.151
-0.1	-0.079	-0.085	-0.090	-0.120	-0.127	-0.135	-0.137	-0.144	-0.152
0	0	0	0	0	0	0	0	0	0
0.1	0.079	0.085	0.090	0.120	0.127	0.135	0.137	0.144	0.152
0.2	0.120	0.127	0.135	0.143	0.150	0.156	0.141	0.146	0.151
0.3	0.137	0.144	0.152	0.141	0.146	0.151	0.128	0.131	0.133
0.4	0.143	0.150	0.156	0.133	0.136	0.139	0.113	0.114	0.115
0.5	0.144	0.150	0.155	0.123	0.125	0.127	0.099	0.100	0.100
x	0	0	0	0	0	0	0	0	0

μ=0.970

	λ=0.25			λ=0.50			λ=0.75		
x/c	J=0.25	J=0.50	J=0.75	J=0.25	J=0.50	J=0.75	J=0.25	J=0.50	J=0.75
-0.5	-0.162	-0.170	-0.176	-0.133	-0.135	-0.137	-0.106	-0.106	-0.107
-0.4	-0.165	-0.174	-0.181	-0.145	-0.149	-0.152	-0.121	-0.123	-0.124
-0.3	-0.165	-0.174	-0.183	-0.157	-0.163	-0.168	-0.139	-0.142	-0.144
-0.2	-0.155	-0.165	-0.175	-0.165	-0.174	-0.181	-0.157	-0.163	-0.168
-0.1	-0.119	-0.128	-0.137	-0.155	-0.165	-0.175	-0.165	-0.174	-0.183
0	0	0	0	0	0	0	0	0	0
0.1	0.119	0.128	0.137	0.155	0.165	0.175	0.165	0.174	0.183
0.2	0.155	0.165	0.175	0.165	0.174	0.181	0.157	0.163	0.168
0.3	0.165	0.174	0.183	0.157	0.163	0.168	0.139	0.142	0.144
0.4	0.165	0.174	0.181	0.145	0.149	0.152	0.121	0.123	0.124
0.5	0.162	0.170	0.176	0.133	0.135	0.137	0.106	0.106	0.107
x	0	0	0	0	0	0	0	0	0

μ=0.990

	λ=0.25			λ=0.50			λ=0.75		
x/c	J=0.25	J=0.50	J=0.75	J=0.25	J=0.50	J=0.75	J=0.25	J=0.50	J=0.75
-0.5	-0.175	-0.183	-0.190	-0.139	-0.142	-0.144	-0.110	-0.111	-0.111
-0.4	-0.181	-0.191	-0.199	-0.153	-0.158	-0.161	-0.127	-0.128	-0.129
-0.3	-0.185	-0.196	-0.207	-0.168	-0.175	-0.180	-0.146	-0.150	-0.152
-0.2	-0.183	-0.195	-0.208	-0.181	-0.191	-0.199	-0.168	-0.175	-0.180
-0.1	-0.161	-0.173	-0.187	-0.183	-0.195	-0.208	-0.185	-0.196	-0.207
0	0	0	0	0	0	0	0	0	0
0.1	0.161	0.173	0.187	0.183	0.195	0.208	0.185	0.196	0.207
0.2	0.183	0.195	0.208	0.181	0.191	0.199	0.168	0.175	0.180
0.3	0.185	0.196	0.207	0.168	0.175	0.180	0.146	0.150	0.152
0.4	0.181	0.191	0.199	0.153	0.158	0.161	0.127	0.128	0.129
0.5	0.175	0.183	0.190	0.139	0.142	0.144	0.110	0.111	0.111
x	0	0	0	0	0	0	0	0	0

N=3
e=0.992
x=0.00

TABLE 11.13

DIRECT PROPELLER CONTRIBUTION TO SHROUD SURFACE PRESSURE COEFFICIENT c_{Γ}, (x/c)

μ=0.900

	λ=0.25			λ=0.50			λ=0.75		
x/c	J=0.25	J=0.50	J=0.75	J=0.25	J=0.50	J=0.75	J=0.25	J=0.50	J=0.75
-0.5	-0.118	-0.124	-0.129	-0.109	-0.112	-0.113	-0.090	-0.091	-0.091
-0.4	-0.114	-0.120	-0.126	-0.116	-0.119	-0.122	-0.102	-0.103	-0.104
-0.3	-0.104	-0.111	-0.116	-0.119	-0.124	-0.128	-0.113	-0.116	-0.118
-0.2	-0.084	-0.090	-0.096	-0.114	-0.120	-0.126	-0.119	-0.124	-0.128
-0.1	-0.049	-0.054	-0.057	-0.084	-0.090	-0.096	-0.104	-0.111	-0.116
0	0	0	0	0	0	0	0	0	0
0.1	0.049	0.054	0.057	0.084	0.090	0.096	0.104	0.111	0.116
0.2	0.084	0.090	0.096	0.114	0.120	0.126	0.119	0.124	0.128
0.3	0.104	0.111	0.116	0.119	0.124	0.128	0.113	0.116	0.118
0.4	0.114	0.120	0.126	0.116	0.119	0.122	0.102	0.103	0.104
0.5	0.118	0.124	0.129	0.109	0.112	0.113	0.090	0.091	0.091
x	0	0	0	0	0	0	0	0	0

μ=0.940

	λ=0.25			λ=0.50			λ=0.75		
x/c	J=0.25	J=0.50	J=0.75	J=0.25	J=0.50	J=0.75	J=0.25	J=0.50	J=0.75
-0.5	-0.140	-0.148	-0.154	-0.122	-0.125	-0.126	-0.099	-0.099	-0.100
-0.4	-0.139	-0.148	-0.155	-0.131	-0.135	-0.139	-0.112	-0.114	-0.115
-0.3	-0.133	-0.142	-0.151	-0.138	-0.145	-0.150	-0.127	-0.130	-0.133
-0.2	-0.115	-0.125	-0.134	-0.139	-0.148	-0.155	-0.138	-0.145	-0.150
-0.1	-0.076	-0.083	-0.090	-0.115	-0.125	-0.134	-0.133	-0.142	-0.151
0	0	0	0	0	0	0	0	0	0
0.1	0.076	0.083	0.090	0.115	0.125	0.134	0.133	0.142	0.151
0.2	0.115	0.125	0.134	0.139	0.148	0.155	0.138	0.145	0.150
0.3	0.133	0.142	0.151	0.138	0.145	0.150	0.127	0.130	0.133
0.4	0.139	0.148	0.155	0.131	0.135	0.139	0.112	0.114	0.115
0.5	0.140	0.148	0.154	0.122	0.125	0.126	0.099	0.099	0.100
λ	0	0	0	0	0	0	0	0	0

μ=0.970

	λ=0.25			λ=0.50			λ=0.75		
x/c	J=0.25	J=0.50	J=0.75	J=0.25	J=0.50	J=0.75	J=0.25	J=0.50	J=0.75
-0.5	-0.159	-0.168	-0.175	-0.132	-0.135	-0.137	-0.105	-0.106	-0.107
-0.4	-0.161	-0.171	-0.180	-0.143	-0.148	-0.152	-0.120	-0.122	-0.123
-0.3	-0.159	-0.171	-0.182	-0.154	-0.162	-0.167	-0.137	-0.141	-0.144
-0.2	-0.148	-0.162	-0.174	-0.161	-0.171	-0.180	-0.154	-0.162	-0.167
-0.1	-0.113	-0.125	-0.136	-0.148	-0.162	-0.174	-0.159	-0.171	-0.182
0	0	0	0	0	0	0	0	0	0
0.1	0.113	0.125	0.136	0.148	0.162	0.174	0.159	0.171	0.182
0.2	0.148	0.162	0.174	0.161	0.171	0.180	0.154	0.162	0.167
0.3	0.159	0.171	0.182	0.154	0.162	0.167	0.137	0.141	0.144
0.4	0.161	0.171	0.180	0.143	0.148	0.152	0.120	0.122	0.123
0.5	0.159	0.168	0.175	0.132	0.135	0.137	0.105	0.106	0.107
x	0	0	0	0	0	0	0	0	0

μ=0.992

	λ=0.25			λ=0.50			λ=0.75		
x/c	J=0.25	J=0.50	J=0.75	J=0.25	J=0.50	J=0.75	J=0.25	J=0.50	J=0.75
-0.5	-0.173	-0.183	-0.190	-0.139	-0.142	-0.144	-0.110	-0.111	-0.111
-0.4	-0.178	-0.190	-0.200	-0.152	-0.158	-0.161	-0.127	-0.129	-0.130
-0.3	-0.181	-0.195	-0.207	-0.166	-0.174	-0.180	-0.146	-0.150	-0.153
-0.2	-0.178	-0.195	-0.209	-0.178	-0.190	-0.200	-0.166	-0.174	-0.180
-0.1	-0.157	-0.175	-0.191	-0.178	-0.195	-0.209	-0.181	-0.195	-0.207
0	0	0	0	0	0	0	0	0	0
0.1	0.157	0.175	0.191	0.178	0.195	0.209	0.181	0.195	0.207
0.2	0.178	0.195	0.209	0.178	0.190	0.200	0.166	0.174	0.180
0.3	0.181	0.195	0.207	0.166	0.174	0.180	0.146	0.150	0.153
0.4	0.178	0.190	0.200	0.152	0.158	0.161	0.127	0.129	0.130
0.5	0.173	0.183	0.190	0.139	0.142	0.144	0.110	0.111	0.111
x	0	0	0	0	0	0	0	0	0

N= 4
e = 0. 992
χ = 0. 00

TABLE 11.14

DIRECT PROPELLER CONTRIBUTION TO SHROUD SURFACE PRESSURE COEFFICIENT c_{Γ}, (x/c)

μ=0.900

	λ=0.25			λ=0.50			λ=0.75		
x/c	J=0.25	J=0.50	J=0.75	J=0.25	J=0.50	J=0.75	J=0.25	J=0.50	J=0.75
-0.5	-0.119	-0.125	-0.130	-0.110	-0.109	-0.113	-0.090	-0.091	-0.091
-0.4	-0.115	-0.121	-0.126	-0.116	-0.116	-0.122	-0.102	-0.103	-0.104
-0.3	-0.105	-0.111	-0.117	-0.120	-0.120	-0.129	-0.113	-0.116	-0.118
-0.2	-0.085	-0.091	-0.096	-0.115	-0.114	-0.126	-0.120	-0.125	-0.129
-0.1	-0.050	-0.054	-0.057	-0.085	-0.084	-0.096	-0.105	-0.111	-0.117
0	0	0	0	0	0	0	0	0	0
0.1	0.050	0.054	0.057	0.085	0.084	0.096	0.105	0.111	0.117
0.2	0.085	0.091	0.096	0.115	0.114	0.126	0.120	0.125	0.129
0.3	0.105	0.111	0.117	0.120	0.120	0.129	0.113	0.116	0.118
0.4	0.115	0.121	0.126	0.116	0.116	0.122	0.102	0.103	0.104
0.5	0.119	0.125	0.130	0.110	0.109	0.113	0.090	0.091	0.091
x	0	0	0	0	0	0	0	0	0

μ=0.940

	λ=0.25			λ=0.50			λ=0.75		
x/c	J=0.25	J=0.50	J=0.75	J=0.25	J=0.50	J=0.75	J=0.25	J=0.50	J=0.75
-0.5	-0.142	-0.149	-0.155	-0.122	-0.125	-0.127	-0.099	-0.099	-0.100
-0.4	-0.141	-0.149	-0.156	-0.132	-0.136	-0.139	-0.112	-0.114	-0.115
-0.3	-0.134	-0.143	-0.151	-0.140	-0.145	-0.150	-0.127	-0.130	-0.133
-0.2	-0.117	-0.126	-0.134	-0.141	-0.149	-0.156	-0.140	-0.145	-0.150
-0.1	-0.077	-0.084	-0.090	-0.117	-0.126	-0.134	-0.134	-0.143	-0.151
0	0	0	0	0	0	0	0	0	0
0.1	0.077	0.084	0.090	0.117	0.126	0.134	0.134	0.143	0.151
0.2	0.117	0.125	0.134	0.141	0.149	0.156	0.140	0.145	0.150
0.3	0.134	0.143	0.151	0.140	0.145	0.150	0.127	0.130	0.133
0.4	0.141	0.149	0.156	0.132	0.136	0.139	0.112	0.114	0.115
0.5	0.142	0.149	0.155	0.122	0.125	0.127	0.099	0.099	0.100
x	0	0	0	0	0	0	0	0	0

μ=0.970

	λ=0.25			λ=0.50			λ=0.75		
x/c	J=0.25	J=0.50	J=0.75	J=0.25	J=0.50	J=0.75	J=0.25	J=0.50	J=0.75
-0.5	-0.160	-0.168	-0.175	-0.132	-0.135	-0.137	-0.105	-0.106	-0.107
-0.4	-0.163	-0.172	-0.181	-0.144	-0.148	-0.152	-0.121	-0.122	-0.124
-0.3	-0.161	-0.173	-0.183	-0.155	-0.162	-0.167	-0.138	-0.142	-0.144
-0.2	-0.151	-0.163	-0.174	-0.163	-0.172	-0.181	-0.155	-0.162	-0.167
-0.1	-0.116	-0.127	-0.137	-0.151	-0.163	-0.174	-0.161	-0.173	-0.183
0	0	0	0	0	0	0	0	0	0
0.1	0.116	0.127	0.137	0.151	0.163	0.174	0.161	0.173	0.183
0.2	0.151	0.163	0.174	0.163	0.172	0.181	0.155	0.162	0.167
0.3	0.161	0.173	0.183	0.155	0.162	0.167	0.138	0.142	0.144
0.4	0.163	0.172	0.181	0.144	0.148	0.152	0.121	0.122	0.124
0.5	0.160	0.168	0.175	0.132	0.135	0.137	0.105	0.106	0.107
x	0	0	0	0	0	0	0	0	0

μ=0.992

	λ=0.25			λ=0.50			λ=0.75		
x/c	J=0.25	J=0.50	J=0.75	J=0.25	J=0.50	J=0.75	J=0.25	J=0.50	J=0.75
-0.5	-0.175	-0.184	-0.191	-0.140	-0.142	-0.145	-0.110	-0.111	-0.112
-0.4	-0.180	-0.191	-0.200	-0.153	-0.158	-0.162	-0.127	-0.129	-0.130
-0.3	-0.184	-0.197	-0.208	-0.168	-0.175	-0.181	-0.146	-0.150	-0.153
-0.2	-0.181	-0.196	-0.210	-0.180	-0.191	-0.200	-0.168	-0.175	-0.181
-0.1	-0.161	-0.177	-0.192	-0.181	-0.196	-0.210	-0.184	-0.197	-0.208
0	0	0	0	0	0	0	0	0	0
0.1	0.161	0.177	0.192	0.181	0.196	0.210	0.184	0.197	0.208
0.2	0.181	0.196	0.210	0.180	0.191	0.200	0.168	0.175	0.181
0.3	0.184	0.197	0.208	0.168	0.175	0.181	0.146	0.150	0.153
0.4	0.180	0.191	0.200	0.153	0.158	0.162	0.127	0.129	0.130
0.5	0.175	0.184	0.191	0.140	0.142	0.145	0.110	0.111	0.112
x	0	0	0	0	0	0	0	0	0

N= 6
e = 0.992
x = 0.00

TABLE 11.15

DIRECT PROPELLER CONTRIBUTION TO SHROUD SURFACE PRESSURE COEFFICIENT c_Γ, (x/c)

μ=0.900

	λ=0.25			λ=0.50			λ=0.75		
x/c	J=0.25	J=0.50	J=0.75	J=0.25	J=0.50	J=0.75	J=0.25	J=0.50	J=0.75
-0.5	-0.121	-0.126	-0.130	-0.110	-0.112	-0.114	-0.090	-0.091	-0.091
-0.4	-0.117	-0.122	-0.127	-0.117	-0.120	-0.123	-0.102	-0.103	-0.104
-0.3	-0.107	-0.113	-0.118	-0.121	-0.126	-0.129	-0.114	-0.116	-0.118
-0.2	-0.087	-0.092	-0.097	-0.117	-0.122	-0.127	-0.121	-0.126	-0.129
-0.1	-0.052	-0.055	-0.058	-0.087	-0.092	-0.097	-0.107	-0.113	-0.118
0	0	0	0	0	0	0	0	0	0
0.1	0.052	0.055	0.058	0.087	0.092	0.097	0.107	0.113	0.118
0.2	0.087	0.092	0.097	0.117	0.122	0.127	0.121	0.126	0.129
0.3	0.107	0.113	0.118	0.121	0.126	0.129	0.114	0.116	0.118
0.4	0.117	0.122	0.127	0.117	0.120	0.123	0.102	0.103	0.104
0.5	0.121	0.126	0.130	0.110	0.112	0.114	0.090	0.091	0.091
x	0	0	0	0	0	0	0	0	0

μ=0.940

	λ=0.25			λ=0.50			λ=0.75		
x/c	J=0.25	J=0.50	J=0.75	J=0.25	J=0.50	J=0.75	J=0.25	J=0.50	J=0.75
-0.5	-0.144	-0.150	-0.156	-0.123	-0.125	-0.127	-0.099	-0.100	-0.100
-0.4	-0.143	-0.150	-0.157	-0.133	-0.137	-0.139	-0.113	-0.114	-0.115
-0.3	-0.137	-0.145	-0.153	-0.141	-0.147	-0.151	-0.128	-0.131	-0.133
-0.2	-0.121	-0.128	-0.136	-0.143	-0.150	-0.157	-0.141	-0.147	-0.151
-0.1	-0.080	-0.086	-0.091	-0.121	-0.128	-0.136	-0.137	-0.145	-0.153
0	0	0	0	0	0	0	0	0	0
0.1	0.080	0.086	0.091	0.121	0.128	0.136	0.137	0.145	0.153
0.2	0.121	0.128	0.136	0.143	0.150	0.157	0.141	0.147	0.151
0.3	0.137	0.145	0.153	0.141	0.147	0.151	0.128	0.131	0.133
0.4	0.143	0.150	0.157	0.133	0.137	0.139	0.113	0.114	0.115
0.5	0.144	0.150	0.156	0.123	0.125	0.127	0.099	0.100	0.100
x	0	0	0	0	0	0	0	0	0

μ=0.970

	λ=0.25			λ=0.50			λ=0.75		
x/c	J=0.25	J=0.50	J=0.75	J=0.25	J=0.50	J=0.75	J=0.25	J=0.50	J=0.75
-0.5	-0.163	-0.170	-0.176	-0.133	-0.135	-0.137	-0.106	-0.106	-0.107
-0.4	-0.166	-0.175	-0.182	-0.145	-0.149	-0.152	-0.121	-0.123	-0.124
-0.3	-0.165	-0.175	-0.184	-0.157	-0.163	-0.168	-0.139	-0.142	-0.145
-0.2	-0.156	-0.166	-0.176	-0.166	-0.175	-0.182	-0.157	-0.163	-0.168
-0.1	-0.120	-0.129	-0.139	-0.156	-0.166	-0.176	-0.165	-0.175	-0.184
0	0	0	0	0	0	0	0	0	0
0.1	0.120	0.129	0.139	0.156	0.166	0.176	0.165	0.175	0.184
0.2	0.156	0.166	0.176	0.166	0.175	0.182	0.157	0.163	0.168
0.3	0.165	0.175	0.184	0.157	0.163	0.168	0.139	0.142	0.145
0.4	0.166	0.175	0.182	0.145	0.149	0.152	0.121	0.123	0.124
0.5	0.163	0.170	0.176	0.133	0.135	0.137	0.106	0.106	0.107
x	0	0	0	0	0	0	0	0	0

μ=0.992

	λ=0.25			λ=0.50			λ=0.75		
x/c	J=0.25	J=0.50	J=0.75	J=0.25	J=0.50	J=0.75	J=0.25	J=0.50	J=0.75
-0.5	-0.177	-0.185	-0.192	-0.140	-0.143	-0.145	-0.111	-0.111	-0.112
-0.4	-0.184	-0.194	-0.202	-0.154	-0.159	-0.162	-0.127	-0.129	-0.130
-0.3	-0.188	-0.200	-0.210	-0.170	-0.176	-0.182	-0.147	-0.151	-0.153
-0.2	-0.187	-0.200	-0.213	-0.184	-0.194	-0.202	-0.170	-0.176	-0.182
-0.1	-0.168	-0.181	-0.195	-0.187	-0.200	-0.213	-0.188	-0.200	-0.210
0	0	0	0	0	0	0	0	0	0
0.1	0.168	0.181	0.195	0.187	0.200	0.213	0.188	0.200	0.210
0.2	0.187	0.200	0.213	0.184	0.194	0.202	0.170	0.176	0.182
0.3	0.188	0.200	0.210	0.170	0.176	0.182	0.147	0.151	0.153
0.4	0.184	0.194	0.202	0.154	0.159	0.162	0.127	0.129	0.130
0.5	0.177	0.185	0.192	0.140	0.143	0.145	0.111	0.111	0.112
x	0	0	0	0	0	0	0	0	0

TABLE 11.16

DIRECT PROPELLER CONTRIBUTION TO SHROUD SURFACE PRESSURE COEFFICIENT c_{Γ}, (x/c)

$\mu = 0.900$

	λ=0.25			λ=0.50			λ=0.75		
x/c	J=0.25	J=0.50	J=0.75	J=0.25	J=0.50	J=0.75	J=0.25	J=0.50	J=0.75
-0.5	-0.119	-0.125	-0.130	-0.109	-0.112	-0.113	-0.090	-0.091	-0.091
-0.4	-0.114	-0.121	-0.127	-0.116	-0.120	-0.122	-0.102	-0.103	-0.104
-0.3	-0.104	-0.111	-0.117	-0.119	-0.125	-0.129	-0.113	-0.116	-0.118
-0.2	-0.084	-0.091	-0.097	-0.114	-0.121	-0.127	-0.119	-0.125	-0.129
-0.1	-0.050	-0.054	-0.058	-0.084	-0.091	-0.097	-0.104	-0.111	-0.117
0	0	0	0	0	0	0	0	0	0
0.1	0.050	0.054	0.058	0.084	0.091	0.097	0.104	0.111	0.117
0.2	0.084	0.091	0.097	0.114	0.121	0.127	0.119	0.125	0.129
0.3	0.104	0.111	0.117	0.119	0.125	0.129	0.113	0.116	0.118
0.4	0.114	0.121	0.127	0.116	0.120	0.122	0.102	0.103	0.104
0.5	0.119	0.125	0.130	0.109	0.112	0.113	0.090	0.091	0.091
x	0	0	0	0	0	0	0	0	0

$\mu = 0.940$

	λ=0.25			λ=0.50			λ=0.75		
x/c	J=0.25	J=0.50	J=0.75	J=0.25	J=0.50	J=0.75	J=0.25	J=0.50	J=0.75
-0.5	-0.141	-0.149	-0.155	-0.122	-0.125	-0.127	-0.099	-0.099	-0.100
-0.4	-0.140	-0.149	-0.156	-0.131	-0.136	-0.139	-0.112	-0.114	-0.115
-0.3	-0.133	-0.144	-0.152	-0.139	-0.145	-0.150	-0.127	-0.130	-0.133
-0.2	-0.117	-0.127	-0.135	-0.140	-0.149	-0.156	-0.139	-0.145	-0.150
-0.1	-0.077	-0.085	-0.091	-0.117	-0.127	-0.135	-0.133	-0.144	-0.152
0	0	0	0	0	0	0	0	0	0
0.1	0.077	0.085	0.091	0.117	0.127	0.135	0.133	0.144	0.152
0.2	0.117	0.127	0.135	0.140	0.149	0.156	0.139	0.145	0.150
0.3	0.133	0.144	0.152	0.139	0.145	0.150	0.127	0.130	0.133
0.4	0.140	0.149	0.156	0.131	0.136	0.139	0.112	0.114	0.115
0.5	0.141	0.149	0.155	0.122	0.125	0.127	0.099	0.099	0.100
x	0	0	0	0	0	0	0	0	0

$\mu = 0.970$

	λ=0.25			λ=0.50			λ=0.75		
x/c	J=0.25	J=0.50	J=0.75	J=0.25	J=0.50	J=0.75	J=0.25	J=0.50	J=0.75
-0.5	-0.159	-0.168	-0.175	-0.132	-0.135	-0.137	-0.105	-0.106	-0.107
-0.4	-0.162	-0.173	-0.181	-0.144	-0.148	-0.152	-0.121	-0.122	-0.124
-0.3	-0.160	-0.173	-0.183	-0.155	-0.162	-0.168	-0.138	-0.142	-0.144
-0.2	-0.150	-0.164	-0.176	-0.162	-0.173	-0.181	-0.155	-0.162	-0.168
-0.1	-0.115	-0.128	-0.139	-0.150	-0.164	-0.176	-0.160	-0.173	-0.183
0	0	0	0	0	0	0	0	0	0
0.1	0.115	0.128	0.139	0.150	0.164	0.176	0.160	0.173	0.183
0.2	0.150	0.164	0.176	0.162	0.173	0.181	0.155	0.162	0.168
0.3	0.160	0.173	0.183	0.155	0.162	0.168	0.138	0.142	0.144
0.4	0.162	0.173	0.181	0.144	0.148	0.152	0.121	0.122	0.124
0.5	0.159	0.168	0.175	0.132	0.135	0.137	0.105	0.106	0.107
x	0	0	0	0	0	0	0	0	0

$\mu = 0.994$

	λ=0.25			λ=0.50			λ=0.75		
x/c	J=0.25	J=0.50	J=0.75	J=0.25	J=0.50	J=0.75	J=0.25	J=0.50	J=0.75
-0.5	-0.175	-0.185	-0.193	-0.140	-0.143	-0.145	-0.111	-0.112	-0.112
-0.4	-0.181	-0.193	-0.203	-0.154	-0.159	-0.163	-0.127	-0.129	-0.130
-0.3	-0.184	-0.199	-0.212	-0.168	-0.176	-0.182	-0.147	-0.151	-0.154
-0.2	-0.183	-0.200	-0.215	-0.181	-0.193	-0.203	-0.168	-0.176	-0.182
-0.1	-0.165	-0.184	-0.201	-0.183	-0.200	-0.215	-0.184	-0.199	-0.212
0	0	0	0	0	0	0	0	0	0
0.1	0.165	0.184	0.201	0.183	0.200	0.215	0.184	0.199	0.212
0.2	0.183	0.200	0.215	0.181	0.193	0.203	0.168	0.176	0.182
0.3	0.184	0.199	0.212	0.168	0.176	0.182	0.147	0.151	0.154
0.4	0.181	0.193	0.203	0.154	0.159	0.163	0.127	0.129	0.130
0.5	0.175	0.185	0.193	0.140	0.143	0.145	0.111	0.112	0.112
x	0	0	0	0	0	0	0	0	0

N=4
e=0.994
χ=0.00

TABLE 11.17

DIRECT PROPELLER CONTRIBUTION TO SHROUD SURFACE PRESSURE COEFFICIENT c_Γ, (x/c)

μ=0.900

x/c	λ=0.25 J=0.25	λ=0.25 J=0.50	λ=0.25 J=0.75	λ=0.50 J=0.25	λ=0.50 J=0.50	λ=0.50 J=0.75	λ=0.75 J=0.25	λ=0.75 J=0.50	λ=0.75 J=0.75
-0.5	-0.120	-0.126	-0.130	-0.110	-0.112	-0.114	-0.090	-0.091	-0.091
-0.4	-0.115	-0.122	-0.127	-0.117	-0.120	-0.123	-0.102	-0.103	-0.104
-0.3	-0.105	-0.112	-0.118	-0.120	-0.125	-0.129	-0.113	-0.116	-0.118
-0.2	-0.086	-0.092	-0.097	-0.115	-0.122	-0.127	-0.120	-0.125	-0.129
-0.1	-0.051	-0.055	-0.058	-0.086	-0.092	-0.097	-0.105	-0.112	-0.118
0	0	0	0	0	0	0	0	0	0
0.1	0.051	0.055	0.058	0.086	0.092	0.097	0.105	0.112	0.118
0.2	0.086	0.092	0.097	0.115	0.122	0.127	0.120	0.125	0.129
0.3	0.105	0.112	0.118	0.120	0.125	0.129	0.113	0.116	0.118
0.4	0.115	0.122	0.127	0.117	0.120	0.123	0.102	0.103	0.104
0.5	0.120	0.126	0.130	0.110	0.112	0.114	0.090	0.091	0.091
x	0	0	0	0	0	0	0	0	0

μ=0.940

x/c	λ=0.25 J=0.25	λ=0.25 J=0.50	λ=0.25 J=0.75	λ=0.50 J=0.25	λ=0.50 J=0.50	λ=0.50 J=0.75	λ=0.75 J=0.25	λ=0.75 J=0.50	λ=0.75 J=0.75
-0.5	-0.142	-0.149	-0.155	-0.122	-0.125	-0.127	-0.099	-0.099	-0.100
-0.4	-0.141	-0.150	-0.157	-0.132	-0.136	-0.139	-0.112	-0.114	-0.115
-0.3	-0.135	-0.144	-0.152	-0.140	-0.146	-0.151	-0.127	-0.131	-0.133
-0.2	-0.118	-0.128	-0.136	-0.141	-0.150	-0.157	-0.140	-0.146	-0.151
-0.1	-0.078	-0.085	-0.092	-0.118	-0.128	-0.136	-0.135	-0.144	-0.152
0	0	0	0	0	0	0	0	0	0
0.1	0.078	0.085	0.092	0.118	0.128	0.136	0.135	0.144	0.152
0.2	0.118	0.128	0.136	0.141	0.150	0.157	0.140	0.146	0.151
0.3	0.135	0.144	0.152	0.140	0.146	0.151	0.127	0.131	0.133
0.4	0.141	0.150	0.157	0.132	0.136	0.139	0.112	0.114	0.115
0.5	0.142	0.149	0.155	0.122	0.125	0.127	0.099	0.099	0.100
x	0	0	0	0	0	0	0	0	0

μ=0.970

x/c	λ=0.25 J=0.25	λ=0.25 J=0.50	λ=0.25 J=0.75	λ=0.50 J=0.25	λ=0.50 J=0.50	λ=0.50 J=0.75	λ=0.75 J=0.25	λ=0.75 J=0.50	λ=0.75 J=0.75
-0.5	-0.161	-0.169	-0.176	-0.132	-0.135	-0.137	-0.105	-0.106	-0.107
-0.4	-0.163	-0.173	-0.182	-0.144	-0.149	-0.152	-0.121	-0.123	-0.124
-0.3	-0.162	-0.174	-0.184	-0.156	-0.163	-0.168	-0.138	-0.142	-0.144
-0.2	-0.152	-0.165	-0.177	-0.163	-0.173	-0.182	-0.156	-0.163	-0.168
-0.1	-0.118	-0.129	-0.140	-0.152	-0.165	-0.177	-0.162	-0.174	-0.184
0	0	0	0	0	0	0	0	0	0
0.1	0.118	0.129	0.140	0.152	0.165	0.177	0.162	0.174	0.184
0.2	0.152	0.165	0.177	0.163	0.173	0.182	0.156	0.163	0.168
0.3	0.162	0.174	0.184	0.156	0.163	0.168	0.138	0.142	0.144
0.4	0.163	0.173	0.182	0.144	0.149	0.152	0.121	0.123	0.124
0.5	0.161	0.169	0.176	0.132	0.135	0.137	0.105	0.106	0.107
x	0	0	0	0	0	0	0	0	0

μ=0.994

x/c	λ=0.25 J=0.25	λ=0.25 J=0.50	λ=0.25 J=0.75	λ=0.50 J=0.25	λ=0.50 J=0.50	λ=0.50 J=0.75	λ=0.75 J=0.25	λ=0.75 J=0.50	λ=0.75 J=0.75
-0.5	-0.176	-0.186	-0.193	-0.140	-0.143	-0.145	-0.111	-0.112	-0.112
-0.4	-0.183	-0.194	-0.204	-0.154	-0.159	-0.163	-0.128	-0.129	-0.131
-0.3	-0.187	-0.201	-0.213	-0.169	-0.177	-0.183	-0.147	-0.151	-0.154
-0.2	-0.186	-0.202	-0.216	-0.183	-0.194	-0.204	-0.169	-0.177	-0.183
-0.1	-0.168	-0.186	-0.202	-0.186	-0.202	-0.216	-0.187	-0.201	-0.213
0	0	0	0	0	0	0	0	0	0
0.1	0.168	0.186	0.202	0.186	0.202	0.216	0.187	0.201	0.213
0.2	0.186	0.202	0.216	0.183	0.194	0.204	0.169	0.177	0.183
0.3	0.187	0.201	0.213	0.169	0.177	0.183	0.147	0.151	0.154
0.4	0.183	0.194	0.204	0.154	0.159	0.163	0.128	0.129	0.131
0.5	0.176	0.186	0.193	0.140	0.143	0.145	0.111	0.112	0.112
x	0	0	0	0	0	0	0	0	0

N = 6
e = 0.994
χ = 0.00

TABLE 11.18

DIRECT PROPELLER CONTRIBUTION TO SHROUD SURFACE PRESSURE COEFFICIENT $c_{\Gamma}, (x/c)$

μ=0.900

	λ=0.25			λ=0.50			λ=0.75		
x/c	J=0.25	J=0.50	J=0.75	J=0.25	J=0.50	J=0.75	J=0.25	J=0.50	J=0.75
-0.5	-0.121	-0.127	-0.131	-0.110	-0.112	-0.114	-0.090	-0.091	-0.091
-0.4	-0.117	-0.123	-0.128	-0.117	-0.121	-0.123	-0.102	-0.103	-0.104
-0.3	-0.107	-0.113	-0.119	-0.122	-0.126	-0.130	-0.114	-0.117	-0.119
-0.2	-0.088	-0.093	-0.098	-0.117	-0.123	-0.128	-0.122	-0.126	-0.130
-0.1	-0.052	-0.055	-0.059	-0.088	-0.093	-0.098	-0.107	-0.113	-0.119
0	0	0	0	0	0	0	0	0	0
0.1	0.052	0.055	0.059	0.088	0.093	0.098	0.107	0.113	0.119
0.2	0.088	0.093	0.098	0.117	0.123	0.128	0.122	0.126	0.130
0.3	0.107	0.113	0.119	0.122	0.126	0.130	0.114	0.117	0.119
0.4	0.117	0.123	0.128	0.117	0.121	0.123	0.102	0.103	0.104
0.5	0.121	0.127	0.131	0.110	0.112	0.114	0.090	0.091	0.091
x	0	0	0	0	0	0	0	0	0

μ=0.940

	λ=0.25			λ=0.50			λ=0.75		
x/c	J=0.25	J=0.50	J=0.75	J=0.25	J=0.50	J=0.75	J=0.25	J=0.50	J=0.75
-0.5	-0.144	-0.151	-0.156	-0.123	-0.125	-0.127	-0.099	-0.100	-0.100
-0.4	-0.144	-0.151	-0.158	-0.133	-0.137	-0.140	-0.113	-0.114	-0.115
-0.3	-0.138	-0.146	-0.154	-0.142	-0.147	-0.151	-0.128	-0.131	-0.133
-0.2	-0.121	-0.130	-0.137	-0.144	-0.151	-0.158	-0.142	-0.147	-0.151
-0.1	-0.081	-0.087	-0.093	-0.121	-0.130	-0.137	-0.138	-0.146	-0.154
0	0	0	0	0	0	0	0	0	0
0.1	0.081	0.087	0.093	0.121	0.130	0.137	0.138	0.146	0.154
0.2	0.121	0.130	0.137	0.144	0.151	0.158	0.142	0.147	0.151
0.3	0.138	0.146	0.154	0.142	0.147	0.151	0.128	0.131	0.133
0.4	0.144	0.151	0.158	0.133	0.137	0.140	0.113	0.114	0.115
0.5	0.144	0.151	0.156	0.123	0.125	0.127	0.099	0.100	0.100
x	0	0	0	0	0	0	0	0	0

μ=0.970

	λ=0.25			λ=0.50			λ=0.75		
x/c	J=0.25	J=0.50	J=0.75	J=0.25	J=0.50	J=0.75	J=0.25	J=0.50	J=0.75
-0.5	-0.163	-0.171	-0.177	-0.133	-0.136	-0.137	-0.105	-0.106	-0.107
-0.4	-0.166	-0.175	-0.183	-0.145	-0.150	-0.153	-0.121	-0.123	-0.124
-0.3	-0.166	-0.176	-0.186	-0.158	-0.164	-0.169	-0.139	-0.142	-0.145
-0.2	-0.157	-0.168	-0.178	-0.166	-0.175	-0.183	-0.158	-0.164	-0.169
-0.1	-0.122	-0.131	-0.141	-0.157	-0.168	-0.178	-0.166	-0.176	-0.186
0	0	0	0	0	0	0	0	0	0
0.1	0.122	0.131	0.141	0.157	0.168	0.178	0.166	0.176	0.186
0.2	0.157	0.168	0.178	0.166	0.175	0.183	0.158	0.164	0.169
0.3	0.166	0.176	0.186	0.158	0.164	0.169	0.139	0.142	0.145
0.4	0.166	0.175	0.183	0.145	0.150	0.153	0.121	0.123	0.124
0.5	0.163	0.171	0.177	0.133	0.136	0.137	0.105	0.106	0.107
x	0	0	0	0	0	0	0	0	0

μ=0.994

	λ=0.25			λ=0.50			λ=0.75		
x/c	J=0.25	J=0.50	J=0.75	J=0.25	J=0.50	J=0.75	J=0.25	J=0.50	J=0.75
-0.5	-0.179	-0.188	-0.194	-0.141	-0.144	-0.146	-0.111	-0.112	-0.112
-0.4	-0.186	-0.196	-0.205	-0.155	-0.160	-0.163	-0.128	-0.130	-0.131
-0.3	-0.191	-0.204	-0.214	-0.171	-0.178	-0.184	-0.148	-0.152	-0.154
-0.2	-0.191	-0.205	-0.219	-0.186	-0.196	-0.205	-0.171	-0.178	-0.184
-0.1	-0.175	-0.190	-0.205	-0.191	-0.205	-0.219	-0.191	-0.204	-0.214
0	0	0	0	0	0	0	0	0	0
0.1	0.175	0.190	0.205	0.191	0.205	0.219	0.191	0.204	0.214
0.2	0.191	0.205	0.219	0.186	0.196	0.205	0.171	0.178	0.184
0.3	0.191	0.204	0.214	0.171	0.178	0.184	0.148	0.152	0.154
0.4	0.186	0.196	0.205	0.155	0.160	0.163	0.128	0.130	0.131
0.5	0.179	0.188	0.194	0.141	0.144	0.146	0.111	0.112	0.112
x	0	0	0	0	0	0	0	0	0

TABLES 12.1 - 12.2

LINEARIZED, TWO-DIMENSIONAL CONTRIBUTION OF SHROUD THICKNESS TO SHROUD SURFACE PRESSURE COEFFICIENT $c_f^{2D}(x/c)$ FOR NACA 4-, 5- AND 6-DIGIT AIRFOIL SECTIONS

$$c_f^{2D}(x/c) = -2\left[\frac{v(x/c)}{V} - 1\right]$$

See Ref. 13, Appendix I, for values of $\frac{v(x/c)}{V}$

Accuracy: ± 0.001

TABLE 12.1

LINEARIZED, TWO-DIMENSIONAL CONTRIBUTION OF SHROUD THICKNESS TO SHROUD SURFACE PRESSURE COEFFICIENT $c_f^{2D}(x/c)$

x/c	$t_m/c = 0.06$	$t_m/c = 0.08$	$t_m/c = 0.09$	$t_m/c = 0.10$	$t_m/c = 0.12$	$t_m/c = 0.15$	$t_m/c = 0.18$	$t_m/c = 0.21$	$t_m/c = 0.24$
-0.50	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000
-0.40	-0.202	-0.260	-0.288	-0.316	-0.376	-0.466	-0.552	-0.634	-0.708
-0.30	-0.182	-0.244	-0.274	-0.306	-0.366	-0.458	-0.550	-0.640	-0.736
-0.20	-0.156	-0.212	-0.238	-0.266	-0.324	-0.408	-0.494	-0.580	-0.666
-0.10	-0.132	-0.178	-0.200	-0.224	-0.270	-0.340	-0.410	-0.480	-0.554
0	-0.106	-0.144	-0.164	-0.182	-0.216	-0.262	-0.308	-0.356	-0.408
0.10	-0.084	-0.108	-0.122	-0.134	-0.160	-0.196	-0.232	-0.266	-0.302
0.20	-0.056	-0.078	-0.086	-0.092	-0.106	-0.128	-0.148	-0.170	-0.194
0.30	-0.026	-0.034	-0.036	-0.040	-0.044	-0.048	-0.050	-0.054	-0.064
0.40	0.020	0.032	0.036	0.040	0.044	0.056	0.068	0.086	0.112
0.50	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000

TABLE 12.2

LINEARIZED, TWO-DIMENSIONAL CONTRIBUTION OF SHROUD THICKNESS TO SHROUD SURFACE PRESSURE COEFFICIENT $c_t^{2D}(x/c)$

63 FAMILY

x/c	$t_m/c = 0.06$	$t_m/c = 0.12$	$t_m/c = 0.18$
-0.50	2.000	2.000	2.000
-0.50	-0.144	-0.276	-0.386
0.30	-0.158	-0.322	-0.488
-0.20	-0.168	-0.340	-0.528
-0.10	-0.158	-0.322	-0.490
0	-0.132	-0.260	-0.376
0.10	-0.094	-0.174	-0.238
0.20	-0.046	-0.074	-0.086
0.30	0.006	0.032	0.068
0.40	0.066	0.134	0.204
0.50	0.118	0.222	0.312

64 FAMILY

x/c	$t_m/c = 0.06$	$t_m/c = 0.12$	$t_m/c = 0.18$
-0.50	2.000	2.000	2.000
-0.40	-0.130	-0.248	-0.350
-0.30	-0.148	-0.298	-0.448
-0.20	-0.158	-0.324	-0.500
-0.10	-0.164	-0.342	-0.530
0	-0.138	-0.272	-0.396
0.10	-0.100	-0.186	-0.256
0.20	-0.054	-0.088	-0.106
0.30	0.000	0.020	0.048
0.40	0.062	0.130	0.198
0.50	0.128	0.240	0.332

65 FAMILY

x/c	$t_m/c = 0.06$	$t_m/c = 0.12$	$t_m/c = 0.18$
-0.50	2.000	2.000	2.000
-0.40	-0.116	-0.220	-0.306
-0.30	-0.138	-0.276	-0.410
-0.20	-0.150	-0.308	-0.462
-0.10	-0.156	-0.324	-0.498
0	-0.158	-0.318	-0.470
0.10	-0.120	-0.230	-0.326
0.20	-0.072	-0.130	-0.164
0.30	-0.012	-0.010	0.016
0.40	0.056	0.120	0.196
0.50	0.148	0.270	0.378

66 FAMILY

x/c	$t_m/c = 0.06$	$t_m/c = 0.12$	$t_m/c = 0.18$
-0.50	2.000	2.000	2.000
-0.40	-0.104	-0.194	-0.268
-0.30	-0.124	-0.244	-0.360
-0.20	-0.134	-0.268	-0.404
-0.10	-0.140	-0.284	-0.434
0	-0.146	-0.296	-0.456
0.10	-0.150	-0.308	-0.476
0.20	-0.114	-0.210	-0.282
0.30	-0.040	-0.052	-0.044
0.40	0.052	0.124	0.208
0.50	0.186	0.342	0.468