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NARADCOM SECURITY CLASSIFICATION OF THIS PAGE (Then Date I READ DISTRUCTIONS **REPORT DOCUMENTATION PAGE** PLETING FO ...... . GOVT ACCESSIO TR-76-60-AMEL CONTROL OF A GLIDING PARACHUTE SYSTEM IN A NON-UNIFORM WIND . CONTRACT OR GRANT NUMBER() Allan E. /Pearson Kuang-Chung, Wei DAAG17-73-C-0172 (Brown University . PERFORMING ORGANIZATION NAME AND ADDRESS PROGRAM ELEMENT, PROJECT, TASK Brown University (Div of Eng & Lefschetz Ctr for 622034 Dynamical Systems), Providence, RI 02912 1F262203AH86 031 11. CONTROLLING OFFICE NAME AND ADDRESS US Army Natick Research and Development Command May 76 Aero-Mechanical Engineering Laboratory DRXNM-UE 52 4. MONITORING AGENCY NAME & ADDRESS(II different from Controlling Office) 18. SECURITY CLASS. (of this report) Unclassified 154. DECLASSIFICATION/DOWNGRADING . DISTRIBUTION STATEMENT (of this Report) Approved for public release, distribution unlimited 17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report) ARAF FEB 28 1977 18. SUPPLEMENTARY NOTES 19. KEY WORDS (Continue on reverse side if necessary and identify by block number) Decelerator Trajectories Parachute Automatic Guidance **Optimel Control** Gliding Parachutes Control Theory Guidance Techniques ABSTRACT (Continue on reverse alde if necessary and identify by block number) This report investigates a method for post deployment guiding of a cargocarrying gliding parachute to a target. Least squares estimation and an openloop control law based on geometric considerations are combined to define a closed-loop control law for the system under variable wind conditions. Simula tion studies of the overall system are included for a variety of initial conditions and wind profiles. These simulations indicate that the proposed algorithm, with additional experimentation, may be a feasible solution to the problem. 00, 100 1 1473 EDITION OF 1 NOV 68 10 S OBSOLETE Unclassified ECURITY CLASSIFICATION OF THIS PAGE (Man Date 2

PREFACE

This report was prepared under contract with Brown University in the Division of Engineering and Lefschetz Center for Dynamical Systems. The work was carried out under Exploratory Development, Project 1F262203AH86, Control of Gliding Parachute Systems, for the U.S. Army Natick Research and Development Command, Natick, Massachusetts. Mr. Arthur L. Murphy, Jr., of the Engineering Sciences Division, Aero-Mechanical Engineering Laboratory, was the Project Engineer for this effort.



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#### CONTROL OF A GLIDING PARACHUTE SYSTEM IN A NON-UNIFORM WIND

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## I. INTRODUCTION

The basic philosophy underlying an approach to the control of a gliding parachute system in a non-uniform wind was introduced in Section I of Pearson [1] with continuing investigations reported in [2] and [3]. This philosophy separates the wind and initial heading estimation problems from the control problem in minimizing the terminal distance of the parachute from a known target while orienting the parachute upwind at the terminal time. Various aspects of the control problem were considered in [1-3] including a computer simulation study of a Differential Dynamic Programming algorithm for solving the open-loop optimal control problem [2], a parameter search algorithm and analytical investigation for the optimal control problem [3], and a bang-off-bang control algorithm based on geometric considerations [3].

In this report the wind estimation and initial heading estimation problems are examined in Section II with particular emphasis given to a least squares formulation. Using the bang-off-bang (open-loop) control law described in Section VI of [3], the least squares and open-loop control algorithms are combined to yield a closed-loop control law which has been simulated under a variety of non-uniform wind conditions. The results of this simulation are included in Section III. Other types of estimation schemes have been considered in this study and are discussed in Section II, but only the least squares algorithm has been used in these initial simulations of the closed-loop control law due to the relative simplicity in computing the least squares estimate.

The equations of motion used throughout this study, [1-3], are the kinematic relations for a uniform descent of the gliding parachute system after full

deployment has ensued:

i.e. .

$$\dot{p}_{1}(t) = a \cos \theta(t) + w_{1}(t)$$

$$\dot{p}_{2}(t) = a \sin \theta(t) + w_{2}(t) \quad 0 \leq t \leq T \qquad (1)$$

$$\dot{\theta}(t) = \frac{g}{2} \tan \phi(t) .$$

(2)

(3)

In these relations,  $(p_1(t), p_2(t))$  denote the position coordinates at time t of the parachute in the horizontal plane relative to the target,  $(w_1(t), w_2(t))$ denote the velocity components of the wind vector (assumed to lie in the horizontal plane at all times),  $\theta(t)$  is the instantaneous heading of the parachute velocity vector relative to fixed coordinates, and  $\phi(t)$  is the parachute bank angle relative to the local vertical. The magnitude of the parachute velocity vector relative to the wind is denoted by "a" in Eq. (1), a presumed known constant of sufficient magnitude to facilitate a wind penetration capability; T is the time to go until touchdown from the initial launch time zero. Alternatively, the third equation in (1) can be expressed in terms of the instantaneous radius of turn of the parachute, r(t), in the horizontal plane via the well known kinematic relation

$$\tan \phi = \frac{a^2}{gr}$$
$$\dot{\theta}(t) = \frac{a}{r(t)} .$$

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Let the time interval 0  $\leq$  t  $\leq$  T be divided into N non-overlapping subintervals  $t_i \leq t \leq t_{i+1}$ ,  $i = 0, \dots, N-1$ , with  $t_o = 0$  and  $t_N = T$ . The estimation problem relative to the i-<u>th</u> subinterval,  $t_i \leq t \leq t_{i+1}$ , consists of estimating the initial heading,  $\theta(t_i)$ , and the wind profile w(t) over  $t_i \leq t \leq T$ , based on observed data collected over the previous subinterval or intervals. The observed data is assumed to be comprised of the parachute bank angle  $\phi(t)$ , the position vector p(t), and possibly (depending on the estimation scheme) the total velocity vector of the parachute  $\dot{p}(t)$ . Given the estimates  $\hat{\theta}(t_i)$  and  $\hat{w}(t)$  for  $t_i \leq t \leq T$ , the control problem relative to the i-<u>th</u> subinterval consists of choosing the bank angle  $\phi(t)$ , or equivalently the turning radius r(t), on  $t_i \leq t \leq t_{i+1}$  such that the parachute would land as close to the target as possible in an upward wind direction at the terminal time if, in fact, the estimates  $\hat{\theta}(t_i)$  and  $\hat{w}(t)$  were exact and  $\phi(t)$  were applied for all t in the interval  $t_i \in t \in T$ . The estimates  $(\hat{\theta}, \hat{w}(\cdot))$  are updated over the next subinterval based on the new data collected over that interval, and similarly the control variable  $\phi(t)$  is re-computed based on the new estimates, resulting in a step-by-step control-estimation sequence which constitutes the closed-loop control algorithm. As discussed in previous reports, control is assumed to be effected through the use of an on-board servo motor attached to the support lines of the gliding parachute with the actual relation between  $\phi(t)$  and the angular position of the servo motor to be determined by the particular hardware so assembled. All computations would presumably be performed by a digital computer located at the target with appropriate telecommunications linking the ground based target and the parachute. However, the computations are sufficiently simple that on-board digital computations might be feasible if such were desired.

II. WIND AND INITIAL HEADING ESTIMATION

Let  $t_0 \le t \le t_1$  be a typical subinterval over which data is observed and it is desired to obtain estimates of the wind profile w(t) and initial heading angle  $\theta(t_0) = \theta_0$  for purposes of updating the control algorithm on the next subinterval. A general approach to this problem would model w(t) as a stochastic process, perhaps with an underlying Markov process representation, and proceed to derive the partial differential equations from which the conditional means of w(t) and  $\theta_0$  could be obtained given the data. However, there is little motivation to formulate this full blown version of the estimation problem, at least at this stage of the investigation, due to the rather extensive computational requirements anticipated in solving the partial differential equations. Therefore, in this section the simpler least equares estimation of w(t) and  $\theta_0$  will be formulated and solved in closed form. Regarding other estimation schemes, a minimum variance

estimate of the wind direction and initial parachute heading will be discussed for the special case in which the magnitude of the wind vector is a known constant.

(a) A Least Squares Estimate

Let the wind components in (1) be modeled by the polynomials of preselected order n:

$$w_1(t) = \sum_{i=0}^{n} \alpha_i t^i$$
$$w_2(t) = \sum_{i=0}^{n} \beta_i t^i$$

In practical terms n would probably be chosen as either n = 0 (a constant wind of unknown magnitude and direction), or n = 1 (a variable wind with linear time varying components). A least squares estimate of the parameters  $(\theta_0, \alpha_0..\alpha_n, \beta_0..\beta_n)$  results upon minimizing the functional

$$J(\theta_{0},\alpha,\beta) = \int_{t_{0}}^{t_{1}} [\dot{p}_{1}(t) - a \cos (\theta_{0} + U(t)) - \sum_{i=0}^{n} \alpha_{i} t^{i}]^{2} dt + \int_{t_{0}}^{t_{1}} [\dot{p}_{2}(t) - a \sin (\theta_{0} + U(t)) - \sum_{i=0}^{n} \beta_{i} t^{i}]^{2} dt$$
(5)

(4)

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(6)

where U(t) is defined in terms of the bank angle  $\phi(t)$  by

$$U(t) = \frac{g}{a} \int_{t_{-}}^{t} tan \phi(\tau) d\tau$$

A necessary condition for the minimization of (5) is the adherence of the following relations:

$$\frac{\partial J}{\partial \theta_0} = 0, \quad \frac{\partial J}{\partial \alpha_1} = 0, \quad \frac{\partial J}{\partial \beta_1} = 0$$

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Since J is quadratic in the  $\alpha_i$  and  $\beta_i$  parameters, the second and third sets of equations in (6) are linear in  $(\alpha,\beta)$  and can be solved uniquely for  $(\alpha,\beta)$  in terms of  $\theta_0$  and the data. The coefficient matrix for the linear equations in  $(\alpha,\beta)$  is the Gramian for the functions  $\{1,t..t^n\}$  on  $t_0 \le t \le t_1$ , i.e., the symmetric matrix whose ij-th component (i = 0..n and j = 0..n) is defined by

$$G_{ij} = \int_{t_0}^{t_1} t^{i+j} dt = \frac{t_1^{i+j+1} - t_0^{i+j+1}}{i+j+1}$$
(7)

# 0 \$ i,j \$ n .

Since  $\{1, t..t^n\}$  are linearly independent for any  $t_1 > t_0$ , the inverse matrix of G exists and can be precomputed and stored for any given  $t_0 \le t \le t_1$  interval. Letting  $H_{ij}$  denote the ij-<u>th</u> component of the inverse matrix,  $G^{-1}$ , the solutions for  $a_i$  and  $\beta_i$  become (details omitted):

$$a_{i} = \sum_{j=0}^{n} H_{ij}[X_{j} - a(C_{j} \cos \theta_{o} - S_{j} \sin \theta_{o})]$$

$$B_{i} = \sum_{j=0}^{n} H_{ij}[Y_{j} - a(C_{j} \sin \theta_{o} + S_{j} \cos \theta_{o})]$$
(8)

where the scalars (C<sub>j</sub>,S<sub>j</sub>,X<sub>j</sub>,Y<sub>j</sub>) are given by

$$c_{j} = \int_{t_{0}}^{t_{1}} t^{j} \cos U(t) dt, \quad s_{j} = \int_{t_{0}}^{t_{1}} t^{j} \sin U(t) dt \qquad (9)$$
$$x_{j} = \int_{t_{0}}^{t_{1}} t^{j} \dot{p}_{1}(t) dt, \quad Y_{j} = \int_{t_{0}}^{t_{1}} t^{j} \dot{p}_{2}(t) dt \qquad (10)$$

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Substituting Eq. (8) into the first of the relations in (6) leads to the result

$$\frac{\partial J}{\partial \theta_{o}} = 0 = A \sin \theta_{o} - B \cos \theta_{o}$$
(11)

where A and B are defined by

$$A = \int_{t_0}^{t_1} [\dot{p}_1(t) \cos U(t) + \dot{p}_2(t) \sin U(t)]dt$$

$$- \sum_{i=0}^{n} \sum_{j=0}^{n} H_{ij}[X_j C_i + Y_j S_i]$$
(12)

and

$$B = \int_{t_{0}}^{t_{1}} [\dot{p}_{2}(t) \cos U(t) - \dot{p}_{1}(t) \sin U(t)]dt$$

$$+ \int_{i=0}^{n} \int_{j=0}^{n} H_{ij}[X_{j}S_{i} - Y_{j}C_{i}]$$
(13)

respectively. Assuming the bank angle  $\phi(t)$  is not identically zero on t<sub>o</sub>  $\xi$  t  $\xi$  t<sub>1</sub>, or equivalently that U(t) is not identically zero, (11) can be solved for  $\theta_0$ , modulo  $2\pi$ , taking into account that a minimal value is desired, i.e., taking note of the condition that

$$\frac{\partial^2 J}{\partial \theta_0^2} > 0 .$$

This solution is given by

which are some

$$\hat{\theta}_{o} = 2m\pi + \tan^{-1}\frac{B}{A}$$
(14)

where m is any integer. Substituting (14) into (8) then yields the final closed-form solution for the least squares estimates of the quantities  $(\theta_{\alpha}, \alpha, \beta)$ .

The above solution is contingent on the condition that  $\phi(t) \neq 0$  because A and B each vanish if  $\phi(t) = 0$  on  $t_0 \leq t \leq t_1$ . In the event that  $\phi(t) = 0$  for all t on t<sub>0</sub>  $\leq$  t  $\leq$  t<sub>1</sub>,  $\theta_0$  cannot be estimated from the given data. In this case a prior value for  $\theta_0$  should be assumed, based on data collected over a previous subinterval in which  $\phi(t) \neq 0$ , and  $(\alpha, \beta)$  can be obtained from

$$\hat{\alpha}_{i} = \sum_{j=0}^{n} H_{ij} (X_{j} - aG_{jo} \cos \hat{\theta}_{o})$$

$$\hat{\beta}_{i} = \sum_{j=0}^{n} H_{ij} (Y_{j} - aG_{jo} \sin \hat{\theta}_{o})$$
(15)

where  $\hat{\theta}_{0}$  is the a priori value assumed for  $\theta_{0}$ .

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Finally, it should be noted that the integrals involving the total velocity vector of the parachute,  $\dot{p}(t)$ , in (10), (12) and (13) can be equivalently expressed in terms of p(t) using integration by parts, i.e.,

$$x_{j} = t_{1}^{j} p_{1}(t_{1}) - t_{0}^{j} p_{1}(t_{0}) - j \int_{t_{0}}^{t_{1}} t^{j-1} p_{1}(t) dt$$

$$x_{j} = t_{1}^{j} p_{2}(t_{1}) - t_{0}^{j} p_{2}(t_{0}) - j \int_{t_{0}}^{t_{1}} t^{j-1} p_{2}(t) dt$$
(16)

$$f_{t_{o}}^{1}(t) \cos U(t)dt = p_{i}(t_{1}) \cos U(t_{1}) - p_{i}(t_{o}) + \frac{g}{a} \int_{t_{o}}^{t_{1}} p_{i}(t) \tan \phi(t) \sin U(t)dt$$

i = 1.2 .

$$\int_{-}^{1} \dot{p}_{i}(t) \sin U(t) dt = p_{i}(t_{1}) \sin U(t_{1})$$

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 $-\frac{g}{a}\int_{t}^{1} p_{i}(t) \tan \phi(t) \cos U(t)dt$ 

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Thus, a knowledge of the data  $(p(t), \phi(t))$  on  $t_0 \le t \le t_1$  is sufficient to obtain the least squares estimate of the wind model (4) and initial heading  $\theta(t_0)$ .

## (b) Statistical Estimates

Although the general estimation problem for a stochastic wind w(t) and random initial heading  $\theta(t_0)$  is probably intractable for on-line considerations, there is one special case that leads to a reasonably straightforward solution in computing a minimum variance estimate. This approach involves nonlinear transformations on the data to achieve an underlying linear Markov process in a manner similar to that used by Willsky and Lo [4] for a different but related estimation problem. The stochastic differential equations for this case are assumed as follows:

$$\dot{p}_{1}(t) = a \cos (\theta(t) + \xi_{1}(t)) + b \cos (\omega(t) + \xi_{2}(t))$$
(18)  
$$\dot{p}_{2}(t) = a \sin (\theta(t) + \xi_{2}(t)) + b \sin (\omega(t) + \xi_{2}(t))$$
(19)  
$$d\theta(t) = u(t)dt + dn_{1}(t)$$
(19)  
$$d\omega(t) = c\omega(t)dt + dn_{2}(t) .$$

In the above, the magnitude of the wind vector is assumed to be a known constant parameter "b",  $(\xi_1(t), \xi_2(t))$  are independent "white-noise" Gaussian processes, u(t) is a known deterministic forcing function given by

$$u(t) = \frac{g}{t} tan \phi(t) , \qquad (20)$$

 $(n_1(t), n_2(t))$  are independent Brownian noise processes, and "c" is a given constant characterizing the transitions for the Markov process  $\omega(t)$ .

The measurement data is assumed to consist of the total velocity vector of the parachute,  $\hat{p}(t)$ , as well as the bank angle  $\phi(t)$ . Equivalently, the data is assumed to consist of the triple of functions  $(u(t), z_1(t), z_2(t))$  for

t > t, where where a filter is a labor balw soft to attaching assume that and and a state

$$z_{1}(t) = \frac{1}{a} \dot{p}_{1}(t) = \cos (\theta + \xi_{1}) + \rho \cos (\omega + \xi_{2})$$

$$z_{2}(t) = \frac{1}{a} \dot{p}_{2}(t) = \sin (\theta + \xi_{1}) + \rho \sin (\omega + \xi_{2})$$
(21)

and  $\rho = b/a$  is a known constant. Eliminating the terms involving  $(\omega + \xi_2)$  in (21) yields

$$z_{1}^{2} + z_{2}^{2} + 1 - 2||z|| \sin (\theta + \xi_{1} + \tan^{-1} \frac{z_{1}}{z_{2}}) = \rho^{2}$$
(22)

where  $||z|| = [z_1^2 + z_2^2]^{1/2}$ . Assuming principal values for the angles, (22) is seen to yield two values for  $\theta + \xi_1$  depending on the sign of  $\cos(\theta + \xi_1 + \tan^{-1}\frac{z_1}{z_2})$ :

$$\theta + \xi_{1} = \begin{cases} -\tan^{-1} \frac{z_{1}}{z_{2}} + \sin^{-1} \left[ \frac{z_{1}^{2} + z_{2}^{2} + 1 - \rho^{2}}{2||z||} \right] & \text{if } \psi > 0 \\ \pi + \tan^{-1} \frac{z_{1}}{z_{2}} - \sin^{-1} \left[ \frac{z_{1}^{2} + z_{2}^{2} + 1 - \rho^{2}}{2||z||} \right] & \text{if } \psi < 0 \end{cases}$$

$$(23)$$

where

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$$\psi = \text{sgn cos} \left(\theta + \xi_1 + \tan^{-1} \frac{z_1}{z_2}\right)$$
 (24)

Similarly, the terms involving  $(\theta + \xi_1)$  can be eliminated from (21) yielding the scalar equation

$$z_1^2 + z_2^2 + \rho^2 - 2||z|| \sin (\omega + \xi_2 + \tan^{-1} \frac{z_1}{z_2}) = 1.$$
 (25)

Again, two values for  $(\omega + \xi_2)$  can be obtained from (25) depending on the sign of cos  $(\omega + \xi_2 + \tan^{-1} \frac{z_1}{z_2})$ , (assuming principal values for all angles):

This implies the the value of  $\alpha$  in (20) can be recolved if the filler of the constitute in brackets on the right side of (20) can be determined from the construct can be determined from the construct another the construct of the restruct size this result implement to be another the time the construct the second of the restruct is an the second time angular value  $\frac{g_1}{4t}$  of  $t_1$  + ten  $\frac{g_2}{2t}$ .

$$\omega + \xi_{2} = \begin{cases} -\tan^{-1} \frac{z_{1}}{z_{2}} + \sin^{-1} \left[ \frac{z_{1}^{2} + z_{2}^{2} + \rho^{2} - 1}{2||z||} \right] & \text{if } \phi > 0 \\ \pi + \tan^{-1} \frac{z_{1}}{z_{2}} - \sin^{-1} \left[ \frac{z_{1}^{2} + z_{2}^{2} + \rho^{2} - 1}{2||z||} \right] & \text{if } \phi < 0 \end{cases}$$
(26)

where

• = sgn cos (w + 
$$\xi_2$$
 + tan<sup>-1</sup>  $\frac{z_1}{z_2}$ ). (27)

The ambiguity in the expressions (23) and (26) cannot be resolved in any simple way. However, considering the time derivative of  $\sin (\theta + \xi_1 + \tan^{-1} \frac{z_1}{z_2})$ :

$$\frac{d}{dt}\sin(\theta + \xi_1 + \tan^{-1}\frac{z_1}{z_2}) = \cos(\theta + \xi_1 + \tan^{-1}\frac{z_1}{z_2})\frac{d}{dt}(\theta + \xi_1 + \tan^{-1}\frac{z_1}{z_2})$$
  
= u(t) cos (\theta + \xi\_1 + \tan^{-1}\frac{z\_1}{z\_2}).

The latter approximation holds if the angular rate term  $\frac{d}{dt} (\theta + \xi_1 + \tan^{-1} \frac{z_1}{z_2})$ is dominated by  $\dot{\theta}(t) = u(t)$ . Then the function  $\psi$  in (24) becomes

$$\psi = \{ \text{sgn u(t)} \} \text{sgn} \frac{d}{dt} \sin(\theta + \xi_1 + \tan^{-1} \frac{z_1}{z_2}) .$$
 (28)

But sgn  $\{\frac{d}{dt} \sin (\theta + \xi_1 + \tan^{-1} \frac{z_1}{z_2})\}$  can be expressed in terms of z(t) and  $\dot{z}(t)$  by differentiating (22) and assuming ||z|| > 0:

 $sgn \left\{\frac{d}{dt} sin \left(\theta + \xi_{1} + tan^{-1} \frac{z_{1}}{z_{2}}\right)\right\} = sgn \left\{\left(z_{1} \dot{z}_{1} + z_{2} \dot{z}_{2}\right)\left(z_{1}^{2} + z_{2}^{2} - 1 + \rho^{2}\right)\right\}. (29)$ 

This implies that the value of  $\psi$  in (28) can be resolved if the sign of the quantity in brackets on the right side of (29) can be determined from the measurements. However, it should be reiterated that this result depends on the assumption that  $\dot{\theta}(t) = u(t)$  dominates the angular rate  $\frac{d}{dt}(\theta + \xi_1 + \tan^{-1}\frac{z_1}{z_0})$ .

The value of  $\phi$  in (27) can be related to the value of  $\psi$  from the following trigonometric considerations. Let  $\lambda = \tan^{-1} \frac{z_1}{z_0}$  so that

$$\cos \lambda = \frac{z_2}{||z||}, \quad \sin \lambda = \frac{z_1}{||z||}$$

Then the following identity follows from (21):

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$$z_{1} \cos \lambda - z_{2} \sin \lambda = \cos \lambda \cos(\theta + \xi_{1}) + \rho \cos \lambda \cos(\omega + \xi_{2})$$
$$- \sin \lambda \sin(\theta + \xi_{1}) - \rho \sin \lambda \sin(\omega + \xi_{2})$$
$$= \cos[\lambda + \theta + \xi_{1}] + \rho \cos[\lambda + \omega + \xi_{2}]$$
$$= 0. \qquad (30)$$

But  $\rho$  is positive so that  $\phi = -\psi$ , which resolves the ambiguity in (26) once  $\psi$  is determined.

Given the nonlinear transformations on the data so that the right hand sides of Eqs. (23) and (26) are known at each instant of time t, the second pair of equations in (19) can now be regarded as a vector Markov process with <u>linear</u> <u>measurements</u> as summarized by the following matrix equations:

$$d \begin{bmatrix} 0 \\ u \end{bmatrix} = \begin{bmatrix} 0 & 0 \\ 0 & c \end{bmatrix} \begin{bmatrix} 0 \\ u \end{bmatrix} dt + \begin{bmatrix} 1 \\ 0 \end{bmatrix} u dt + d \begin{bmatrix} n_1 \\ n_2 \end{bmatrix}$$
(31)
$$\begin{bmatrix} \tilde{z}_1 \\ \tilde{z}_2 \end{bmatrix} = \begin{bmatrix} 0 \\ u \end{bmatrix} + \begin{bmatrix} \xi_1 \\ \xi_2 \end{bmatrix}$$
(32)

where z1 and z2 denote the right hand sides of (23) and (26), respectively.

Equations (31) and (32) are now in the standard form for application of the Kalman-Bucy filter [5] in obtaining a minimum variance estimate of the pair ( $\theta(t)$ , u(t)) conditioned on the data ( $\tilde{z}_1(t)$ ,  $\tilde{z}_2(t)$ ). The filter for this estimate is given by

15

 $dx = Ax dt + Bu dt + K(t)[s - x]dt, x(o) = E(x_0)$  (33)

where  $\hat{\mathbf{x}} = (\hat{\theta}, \hat{\omega})$ ; A and B are the coefficient matrices in (31), and the gain matrix K(t) is computed off-line according to

$$K(t) = P(t)R_{2}^{-1}$$

$$\frac{dP}{dt} = AP + PA' + R_{1} - PR_{2}^{-1}P, \quad P(o) = E(x_{0}x_{0}')$$

(34)

; )

where

$$R_{dt} = E(nn')$$

and

$$R_{2} = E(\xi\xi')$$

are presumed to be given covariance matrices with  $R_2$  positive definite. Equation (33) is the real-time realization of this optimal filter given that the gain matrix K(t) has been pre-computed off-line by the integration of the Riccati differential equation in (34).

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## III. CLOSED LOOP CONTROL ALGORITHM

tilling with the

this estimate

Given estimates of the wind vector,  $(w_1(t), w_2(t))$ , over  $t_0 \le t \le T$ , and the initial heading of the parachute relative to wind,  $\theta(t_0)$ , as determined by the least squares formulae of Section II-a involving the data observed over the previous subinterval, the following transformations to normalized coordinates simplify the kinematic equations for control considerations:

$$x_{i}(t) = \frac{1}{(T-t_{o})a} \left[ p_{i}(t) + \int_{t}^{T} w_{i}(\xi) d\xi \right], \quad i = 1,2$$

$$x_{3}(t) = \theta(t) . \qquad (39)$$

Rewriting Eq. (1) in terms of  $(x_1, x_2, x_3)$  and introducing the normalized time  $\tau$ ,

$$\tau = \frac{t - t_o}{T - t_o} , \qquad (36)$$

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and the normalized control variable u,

$$u = \frac{(T-t_o)g}{tan}$$
tan

the kinematic equations become

$$\dot{x}_{1}(\tau) = \cos x_{3}(\tau)$$
  
 $\dot{x}_{2}(\tau) = \sin x_{3}(\tau) \quad 0 \le \tau \le 1$  (38)  
 $\dot{x}_{3}(\tau) = u(\tau)$ .

The desired terminal state in these coordinates is given by:

$$x_1(1) = x_2(1) = 0, \quad x_3(1) = /w(T) + \pi$$
 (39)

where /w(T) denotes the estimated wind direction at the terminal time T.

The optimal control problem of minimizing the control energy,  $\int_{0}^{1} |u(\tau)|^{2} d\tau$ , while driving the system (38) from the initial state

$$x_{i}(o) = \frac{1}{(T-t_{o})a} \left[ p_{i}(t_{o}) + \int_{t_{o}}^{T} w_{i}(\xi) d\xi \right], \quad i = 1, 2$$
  
$$x_{3}(o) = \theta(t_{o})$$

to the terminal state (39) has been investigated in [2] and [3]. Assuming the initial coordinates  $(x_1(o), x_2(o))$  lie within the unit circle, this is a well posed problem with moderately demanding computational requirements in obtaining a solution. The Differential Dynamic Programming algorithm for computing the optimal control, as discussed in [2], requires a large amount of computer storage, but tends to converge in a small number iterations. The parameter search algorithm, discussed in [3] and further investigated via the application of the Davison-Wong technique [6], requires far less memory, but requires many more iterations to converge.

Although each of the optimal control techniques may be feasible if sufficient computer hardware is available, the far simpler bang-off-bang algorithm

• , (37)

(40)

described in Section VI of [3] was utilized for the control algorithm in closing the loop using the step by step estimation-control sequence described in the Introduction. However, provision in this algorithm must be made for the possibility that the initial conditions in (40) may lie outside the unit circle at the start of any particular sub-interval, thereby necessitating an alternative control strategy (not discussed in [2] or [3]) for this situation.

(a) Control Strategy for Initial Conditions Outside the Unit Circle

The following control strategy was adopted for the case in which  $(x_1(o), x_2(o))$  lie outside the unit circle. Let  $u(\tau)$  be constrained to be either one of the two forms:

$$u_{1}(\tau) = \begin{cases} \frac{1}{\gamma} & \text{for } 0 \leq \tau \leq t_{1} \\ 0 & \text{for } t_{1} < \tau \leq 1 \end{cases}$$
(41)

$$u_{2}(\tau) = \begin{cases} 0 \text{ for } 0 \leq \tau \leq t_{1} \\ \frac{1}{\gamma} \text{ for } t_{1} < \tau \leq 1 \end{cases}$$
(42)

(43)

(44)

(45)

where the normalized turning radius,  $\gamma$ , and the switching time t<sub>1</sub> are to be determined by minimizing the function

$$J(t_1) = [x_1^2(1) + x_2^2(1)]$$

subject to the end-point constraint

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or

$$x_3(1) = /w(T) + \pi$$
.

Using the control  $u_1$  in (41), the equations of motion (38) can be integrated yielding an explicit expression for  $J(t_1)$ . The terminal constraint (44) implies the following relation between  $\gamma$  and  $t_1$ :

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Using this constraint and the necessary condition for a minimum,  $\frac{dJ}{dt_1} = 0$ , the following values for  $t_1^*$  and  $J^* = J(t_1^*)$  are obtained:

$$t_{1}^{*} = \frac{1}{d} \left\{ 1 + x_{1}(o) \cos v + x_{2}(o) \sin v + \frac{1}{x_{3}(o) - v} [x_{1}(o) \sin v - x_{2}(o) \cos v - x_{1}(o) \sin x_{2}(o) + x_{2}(o) \cos x_{2}(o) + \sin (v - x_{2}(o))] \right\}$$
(46)

$$J_{1}^{*} = \frac{1}{d} \left\{ x_{2}(0) \cos v - x_{1}(0) \sin v + \frac{1}{v - x_{3}(0)} [x_{1}(0) \cos x_{3}(0) + x_{2}(0) \sin x_{3}(0) + \cos (v - x_{3}(0)) - 1 - x_{1}(0) \cos v - x_{2}(0) \sin v] \right\}^{2}$$

$$(47)$$

where d and v are defined by

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$$v = /w(T) + \pi$$
 (48)

$$d = \frac{\left[v - x_3(o) - \sin\left(v - x_3(o)\right)\right]^2 + 4\sin^4\left(\frac{3}{2}\right)}{\left[v - x_3(o)\right]^2} \qquad (49)$$

With the above value for  $t_1^*$ , it can be shown that  $\frac{d^2J}{dt_1^2} > 0$  so that  $t_1^*$  is a minimal point. This implies that  $u_1$  in (41) will be the proper control to apply (within the present context) provided, in addition, that  $0 \le t_1^* \le 1$  and  $v \ne x_3(o)$ .

In a similar manner, the differential equations can be integrated using the control  $u_2$  in (42) resulting in an explicit relation for  $J(t_1)$ . Again, the terminal constraint (44) implies the following constraint between the radius of turn  $\gamma$  and  $t_1$  (cf. (45)):

$$\frac{1 - t_1}{\frac{1}{\sqrt{w(T)} + \pi - \pi_3(o)}}.$$
 (50)

The minimizing value of  $t_1$  and corresponding minimal value of J in this case is found to be

$$t_{1}^{*} = \frac{1}{d} \left\{ \frac{2 - 2 \cos (v - x_{3}(o))}{[v - x_{3}(o)]^{2}} + \frac{1}{v - x_{3}(o)} [x_{1}(o) \sin v - x_{2}(o) \cos v + x_{2}(o) \cos x_{3}(o) - x_{1}(o) \sin x_{3}(o) - \sin (v - x_{3}(o))] - x_{1}(o) \cos x_{3}(o) - x_{2}(o) \sin x_{3}(o) \right\}$$
(51)

and

.

$$f_{2}^{*} = \frac{1}{d} \left\{ x_{1}(o) \sin x_{3}(o) - x_{2}(o) \cos x_{3}(o) + \frac{1}{\nu - x_{3}(o)} [x_{1}(o) \cos \nu$$

$$+ x_{2}(o) \sin \nu - x_{1}(o) \cos x_{3}(o) - x_{2}(o) \sin x_{3}(o) - 1 + \cos(\nu - x_{3}(o))] \right\}^{2}$$
(52)

As in the previous case,  $u_2$  is feasible only if  $t_1^{\#}$  in (51) satisfies  $0 \le t_1^{\#} \le 1$ . In practice, both cases must be considered for any particular set of initial values  $(x_1(0), x_2(0))$  lying outside the unit circle with the choice,  $u_1$  or  $u_2$ , based on feasibility. It could be that neither case is feasible for certain initial data in which case the value of J can be computed for full on, or full off, control during  $0 \le t \le 1$ , and that control selected which achieves the smaller value for J, consistent with the end point heading constraint (44). These details of the control strategy have been programmed into the Fortran listing supplied in the Appendix.

(b) Simulation Results of the Closed Loop Controller

Simulation studies were carried out for the system (1) using a variety of initial conditions  $(p_1(o), p_2(o), \theta(o))$  and wind profiles  $(w_1(t), w_2(t))$ over the total time interval 0  $\leq$  t  $\leq$  307.5 sec. The speed of the parachute relative to wind was fixed at a = 30 ft/sec. Five subintervals were used for the step-by-step estimation-control sequence with the lengths of these subintervals defined by:

ered will be used to action with approximation for it to enter unitable of the start of the star

 $t_1 = 7.5$ ,  $t_3 = 157.5$  $t_2 = 82.5$ ,  $t_4 = 232.5$ T = 307.5.

A small control effort of magnitude 0.01 was exerted over the first subinterval in order to avoid the degeneracy discussed at the end of Section II-a in estimating the parachute heading  $\theta_{\perp}$ .

All integrations were performed using a fourth order Runge-Kutta subroutine from the IBM Scientific Subroutine Package. A complete Fortran listing of the computer program is given in the Appendix. The differential equations for the parachute, the generation of the wind vector, as well as all the relevant integrals needed for the least squares estimation are integrated in the subroutine labeled CPLANT. A linear time varying wind model was used in the wind estimation subroutine (Eq. (4) with n = 1):

and to excee with the set  $w_1(t) \approx a_0 + a_1 t$  is such the set of the probability in  $w_2(t) = \beta_0 + \beta_1 t .$ 

The actual winds used in the study are given in Table 1. The analytical expressions for both polar and rectangular coordinates of the wind vector are indicated. A step-type disturbance was introduced for some of the runs as indicated by the  $\Delta w_i$  columns in Table 1. These disturbances (where indicated) were imposed at the end of each subinterval according to the rule:

 $w_i(new) = w_i(old) + \Delta w_i, \quad i = 1,2$ .

The parachute trajectories under closed loop control are shown in Figs. 1-11 with corresponding plots for the wind profile and the parachute bank angle. Two different trajectories are shown on each Figure corresponding to the two different sets of initial conditions indicated. The terminal error, ||p(T)||, is the Euclidean distance in feet, while  $\Delta \theta(T)$  denotes the error in the desired parachute heading at the terminal time. These trajectories and data indicate that good terminal accuracy can be obtained for smooth variable winds, with some deterioriation in accuracy for abruptly shifting winds. The bank angles for the most part are quite reasonable, although there were brief moments where bank angles in excess of 30° were called for by the control algorithm. There was no attempt to determine the best sizing of subintervals, nor to experiment with variations in the estimation scheme. Such experimentation is necessary if a practical implementation of this approach is undertaken.

#### IV. CONCLUSIONS

Separating the wind and initial heading estimation problems from the control problem to obtain a step-by-step estimation and control sequence may be a feasible approach to the gliding parachute control problem in a nonuniform wind. It will be difficult to make a more definitive statement until additional simulations and experimentations are carried out. Even within the scope of the relatively simple least squares estimation scheme used in this study, additional experimentation is needed to determine the number and sizing of subintervals  $t_i \notin t \lesssim t_{i+1}$ , whether or not to combine wind estimates over adjacent subintervals by averaging the estimates over several subintervals, and what form of wind model to use in the estimation scheme. The control aspect of the problem is fairly streightforward from a computational viewpoint, but actuator dynamics have been completely neglected as indicated by the instantaneous step changes allowed in the parachute bank angle. More sophisticated estimation and control algorithms might offer better performance, but at the expense of more complex computations.

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Actual Wind Profiles for the Simulations TABLE I

|| w || (>rex())

•1(t)	w <sub>2</sub> (t)	M(E)		L <sup>MD</sup>	DW2
To	-5 + 0.0lt	125-0.1t+10 <sup>-4</sup> t <sup>2</sup>	$t_{am}^{-1} = \frac{-5+0.01t}{10}$	•	
20	0	20	00	•	
20	0	20	00	-2.0	-2.
10 cos 0.01t + 5 sin 0.01t	5 cos 0.01t - 10 sin 0.01t	81.11	26.56°-0.573°t	•	
10 cos 0.01t + 5 sin 0.01t	5 cos 0.01t - 10 sin 0.01t	11.18	26.56°-0.573°t	2.0	2.
10 cos 0.008t + 10 sin 0.008t	10 cos 0.008t - 10 sin 0.008t	14.14	45°-0.458°t	•	1
10 cos 0.008t + 10 sin 0.008t	10 cos 0.008t - 10 sin 0.008t	14.14	45°-0.458°t	2.0	2.
10e <sup>-0.01t</sup>	-5e-0.01t	11.18e <sup>-0.01t</sup>	-26.56°	•	
10e <sup>-0.01t</sup>	-5e <sup>-0.01t</sup>	11.18e <sup>-0.01t</sup>	-26.56°	-2.0	-2.
10e <sup>-0.01t</sup> (cos 0.01t - sin 0.0	(t) -10e <sup>-0.01</sup> t cos 0.01t + sin 0.01t)	14.14e <sup>-0.01t</sup>	-45°-0.573°t	•	
10e <sup>-0.01t</sup> (cos 0.01t - sin 0.0	(t) -10e <sup>-0.01</sup> t cos 0.01t + sin 0.01t)	14.14e <sup>-0.01t</sup>	-45°-0.573°t	1.0	i

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APPENDIX

#### THE BROWN BICENTENNIAL COMPUTER CENTER FILE: MAIN FORTRAN P1 THE PURPUSE IS TO ESTIMATE AND CONTROL A PARACHUTE GLIDING SYSTEM VIA00010 С C VIA A LEAST SQUARE ESTIMATION SCHEME (ESTM) IN ADDITION TO A BANG-VIA00020 C BANG CONTROL SCHEME (PRED). VIA00030 С A:PARACHUTE SPEED; CW: COEFF. MATRIX IN DYNAMIC WIND MODEL VIA00040 DTES: EST. INTERVAL LENGTH ; DTIN: INTEGRATION INTERVAL LENGTH С VIA00050 ERBD : ERROR BOUND IN RINGE-KUTTA ROUTINE ; EX: EST.PARACHUTE HEADINGVIA00060 С EA: EST.X-COMPONENT WIND COEFF. ; EB: EST. Y-COMPONENT WIND COEFF.VIA00070 C IM: NO. OF INTEGRATION INTERVAL ; IN: NO. OF EST. INTERVAL C VIA00080 IP: EXECUTION CONTROL. IF IP=1, STOP EXECUTION BECAUSE THE GEOMETRICVIA00090 C C APPROACH FAILS. ; NC: EST. LOOP COUNT ; TI: INITIAL TIME VIA00100 С TF: FINAL TIME ; TB: STORED SWITCH TIME VECTOR ; XIN:INITIAL STATEVIA00110 XF: FINAL STATE VECTOR, AND INTEGRATED VECTOR ; UM: BANG-OFF CONTROLVIA00120 C C WD: EST. TERMINAL WIND ANGLE ; PI:180 DEGREE IN RADIANS VIA00130 CONV:CONVERSION FACTOR FROM RADIAN TO DEGREE C VIA00140 C FDS: ESTIMATION INTERVAL ; FDI: INTEGRATION STEP SIZE VIA00150 C DG: DEGENERATE BOUND XTF: INTERMEDIATE INITIAL TIME VIA00160 C DEV: TERMINAL DEVIATION FROM WIND OPPOSITE VIA00170 С TC: INITIAL COUNT TIME ; TGO:FLIGHT TIME IN SECOND VIA00180 C RK: FRACTION OF PREDICTION INTERVAL ; ISK: SKIP CONSTANT EST.IF ISKVIA00190 C = 1 V 1400200 IMPLICIT REAL #8(A-H, 0-Z) VIA00210 DIMENSION XIN(3), x F1(22), TB(2), CW(2,2), WIN(2), EA(2), EB(2), TEX(3) VIA00220 COMMON DIES, DIIN, ERUD, TI, TF, NC, IN, IM COMMON/F1/A, UM, TB, CW, WIN, UP, DG, TEX, PI, CONV VIA00230 VIA00240 COMMON/OUT/TPR, THI, THETA, ENR, ALP, DRBE VIA00250 COMMON/PR/WD, IP VIA00260 COMMON/EX/TFIN, RK, ISK VIA00270 WRITE(6,32) VIA00280 32 FORMAT(1H , 'DISTURBANCE, NO. OF DRUPS') VIA00290 READ(5,29)DRBE,NDP VIA00300 VIA00310 DO 30 LD=1,NDP WRITE(6,28) VI A00320 FORMAT(1H , "FRACTION OF PRED,"," SKIP CONTROL") 28 VIA00330 VIA00340 READ(5, 29)RK, ISK FORMAT(D14.8,12) 29 VIA00350 WRITE(6,24) VIA00360 24 FORMAT(1H , 'INITIAL COUNT TIME , TIME TO GO') VIA00370 READ(5,5) TC, TGO VIA00380 WRITE(6,11) VIA00390 FORMAT(1H , 'EST.NO., INTG. ND. , INITIAL STATES, ERROR BOUND ) VI A004 00 11 READ (5,2) IN, IM, (XIN(I), I=1,3), ERBD VIA00410 2 FORMAT(214,4014.8) VIA00420 WRITE(6,9) VI A00430 FORMATEIH , 'PARACHUTE SPEED W.R.T. AIR', ', INITIAL CONTROL') 9 VIA00440 READ(5,5)A,UM VIA00450 WR ITE(6,10) VIA00460 10 FORMAT(1H , INITIAL COND. OF WIND COMPONENTS") VI A00470 READ(5,5)(WIN(I),I=1,2) VIA00480 5 FORM AT (2014.8) VIA00490 WRI TE(6 .8) VI A00500 8 FORMAT(1H , "COEFF. MATRIX IN DYNAMIC WIND MODEL") VIA00510 DO 7 1=1.2 VIA00520 7 READ(5,5)(Cw(1,J), J=1,2) VIA00530 TFIN=TC+TGO VIA00540 PI=DARCOS(-1.DO) VIA00550

.

FILE:	MAIN FORTRAN P1 THE BROWN BICENTENNIAL	COMPUTER CENTER
	CONV=1.802/PI	VI A00560
	FDS=TGO/DFLOAT(IN)	VIA00570
	FDI=FDS/DFLOAT (IM)	V1A00580
	DTE S=0.100*FDS	VIA00590
	DTIN=0.100*FDI	VIA00600
	1P=0	VI A00610
C	Value -	VIA00620
C INI	I LALIZE FINAL STATE, INTG. VECTOR, EST. VECTOR	VIA00630
C		VI A00640
	DO 12 I=1,22	VIA00650
12	XF1(1)=0.D0	VIA00660
	EX=0.D0	VI A00670
	DO 13 1=1,2	VIA00680
	EA(I)=0.D0	VIA00690
13	EB(I)=0.D0	VIA00700
	NC = 0	VIA00710
	T I=0.00	VI A00720
	TF=TI+DTES	VIA00730
	TB(2)=T1	VIA00740
	STF=TC	VIA00750
	TB(1)=TF	V IA00760
C		VIA00770
C COM	PUTE STATE AND INTEGRATED VECTORS	VI A00780
C		V I A00790
1	CALL PLANT(XIN, XF1)	00800AIV
	IF(NC.EQ.IN)GO TO 22	VI A00810
	DG=DTIN+UM++2+.1D-05	VIA00820
C		V[A00830
C EST	IMATE HEADING AND WIND COEFF.	VIA00840
C		VI A00850
	CALL ESTM(XIN,XF1,EX,EA,EB)	VI A 00860
C		VIA00870
C COM	PUTE BANG-BANG CUNTROL ACCORDING TO MODEL EQ. SEST.STATES.	VIADOBBO
C		VIA00890
	CALL PREDIXIN, EX, EA, EB, STF, TIM, TZM, UKJ	VIA00900
C	TE INTIAL COND. START NEWS SETTIATION LOOD	VIA00910
C UPU	ATE INITIAL CUND., START NEXT ESTIMATION LUUP	VIA00920
L.	10-10-11	VIA00930
		VIA00950
		VIA00960
		VIA00970
20		VIACOPRO
21	TETTAEDC	VIA00900
	STE=TE	VIA01000
		VIA01010
		VIA01020
	DTINEEDI	VIA01030
	TRELISTIM	VIA01040
	TB(2)=T2N	VIA01050
	GO TO 1	VIA01060
22	WRITE(6.31)THETA	VIA01070
31	FORMAT (1H, 'REAL ANG. ', 2X, 014.8)	VI A01 080
	IF(XF1(13).EQ.0.D0)G0 TO 25	VIA01090
	DEV=CONV +DHOD( (THET A-DATAN 2(XF1(14), XF1(13))+P1), (2. DO+P1))	VIA01100
		Carling and an and a second

<pre>3 FORMAT(IH ,'THE DEVIATION FROM THE WIND OPPOSITE IS ',2X C'DEGREES.) 0 CONTINUE STOP END </pre>	V IA0112 V IA0113 VIA0114 V IA0115 VIA0116 VIA0117
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HETA EX. MIG.1.2K.4GI4.481 G.0.DOFGE TO 23 G.0.DOFGE TO 23	PS.14(金)出生
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#### NASTRAJAN MURICAN SHIT THE BROWN BICENTENNIAL COMPUTER CENTER FURTRAN PL FILE: CPLANT SUBROUTINE PLANT (& IN, YTEL) PLA00010 THE PURPOSE IS WITH GIVEN INITIAL POSITION, HEADING AS WELL AS WINDPLA00020 C KNOWN DYNAMICS AND CONTROL LAW, COMPUTE THE CORRESPONDING STATES, ANPLADOO30 C INTEGRATED VECTOR WHICH IS NEEDED IN LSQ ESTIMATION. PLA00040 С INPUT: INITIAL STATE VECTOR "XIN" PLA00050 C OUTPUT: FINAL STATE VECTOR AND SOME INTEGRATED VECTOR "YTEL" PLADD060 C. PLA00070 C PL 400080 C IMPLICIT KEAL +8(A-H, 0-Z) PLA00090 PLA00100 DIMENSION XIN(1), Y(14), DERY(14), PRMT (5), AUX(8, 14), YTEL(1), TB(2), PLA00110 CCW(2,21,WIN(2) PLA00120 COMMON/OUT/TP , THI, THE, ENR, ALP PLA00130 COMMON DS, DI, ED, TI, TF, NC, IN, IM COMMON/F1/A, U, TB, CW, WIN, UP PL AJ0140 PLA00150 EXTERNAL FCT1.00TP1 AR HER DRAW, DAME AT 3HT LISTY CLIFT, SIL HI PLA00160 C C INITIALIZE RELATED VECTURS FOR INTEGRATION PURPOSE PLA00170 PLA00180 C PRMT(1)=J1 Grad anathening of the set at a state of the state of the set of t PL 400190 PLA00200 PRMT(2)=TF PLA00210 PRMT(3) =D1 PLA00220 PRMT(4)=EU PLA00230 TP=TI ALP=TI PLA00240 PLA00250 NDIM=14 DO 1 I=1,14 PLA00260 PLA00270 1 DERY(1)=1.DU/14.DO PLA00280 DU 2 [=1,2 PLA00290 Y(1)=X1N(1) 2 THI=XIN(3) PLA00300 DO 3 1=3,12 PLA00310 PLA00320 Y(1)=0.DU 3 PL A00330 DO 6 1=13,14 PLA00340 6 Y(1)=WIN(1-12) PLA00350 WRITE(8,8) FURMAT(1H ,2X, 'TIME',12X, 'X(1)',12X, 'X(2)',12X, 'X(3)',12X, 'WIND', PLA00360 8 PI 400370 C12X, 'ANGL', 10X, 'U', 14X, 'BANK ANG') WRITE(6,7) PI 400380 FORMAT (1H0, 2X, "TIME", 12X, "X(1)", 12X, "X(2)", 12X, "X(3)", 12X, "WIND", 1 PLA00390 7 C2X , 'ANGL', 10X, 'U', 14X, 'ENERGY') PLA00400 PL A00410 C PLA00420 START INTEGRATION C 建立的现在分词 一日月 一日日日 一日日 PL A00430 C CALL DRKGS(PRMT, Y, DERY, NDIM, IHLF, FCT1, OUTP1, AUX) PLA00440 PLA00450 WRITE(6,4)IHLF PLA00460 FORMAT(1HO, ' IHLF=', 12) PL A00470 C PL A004 80 C STORE FINAL STATE AND INTEGRATED VECTOR \$5.1 19.95年天的代生活的的中心中自主了。 PLA00490 C 00 5 1=1,14 PLA00500 5 YTEL(1)=Y(1) PLA00510 RETURN PLA00520 またを予約項目の 自己 医院 医院院 長谷子 END PLA00530 A PERSONAL STREET AND SUBROUTINE OUTPI (X, Y, DERY, IHLF, NDIM, PRMT) PLA00540 这些主要的自己并有了了不知道这些主义者不 PLA00550 IMPLICIT REAL +8(A-H,O-Z)

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#### FILE: CPLANT FORTRAN PI THE BROWN BICENTENNIAL COMPUTER CENTER PLA00560 DIMENSION Y(1), PRMT(1), DERY(1), TB(2), CW(2,2), WIN(2), TEX(3) COMMON DS, DI, ED, TI, TF, NC, IN, IM PLA00570 COMMON DS SUI PEU, TI ST FINC, IN IN COMMON/FI/A, U, TB, CN, WIN, UP, DG, TEX, PI, CV COMMON/OUT/TP, THI, THETA, ENR, ALP PL A00580 PLA00590 COMMON/OUT/TP, THI, THETA, ENR, ALP IF((X.LT.ALP-.500+D1).OR.(X.GT.ALP+.500+D1)) RETURN PLA00600 WMAG=DSQRT(Y(13) ++2+Y(14)++2) PLA00610 IF(Y(14).EQ.0.00)GO TO 2 PLA00620 PLA00630 IF(Y(13).EQ.0.D0)G0 TO 3 WANG=DATAN2(Y(14).Y(13)) +CV PLA00640 PLA00650 GO TO 4 PL A00660 WANG=0.DO 2 GO TO 4 PLA00670 WANG=9.001 PLA00680 3 GO TO 4 PL A00690 BK=DAT AN2 (A+UP, 32.0700)+CV PLA00700 WRITE(8,1)X,Y(1),Y(2), THETA, WMAG, WANG, UP, BK PLA00710 AL P= AL P+ DFLOAT( IM/10) +DI PL A00720 IF ( (X.LT.TP-.500+DI).OR. (X.GT.TP+.500+DI) ) RETURN PLA00730 PLA00740 PRINT OUT 2 CONSECUTIVE SETS OF TIME, STATES, WIND, CONTROL AND ENERGY PLACO 750 C C EST. INTERVAL PLA00760 C PLA00770 WRITE(6,1)X,Y(1),Y(2),THETA,WMAG,WANG,UP, ENR PLA00780 FORMAT(1H ,D10.4,7(2X,D14.8)) PLA00790 1 TP=TP+DFLOAT(IM )+DI PLA00800 PLA00810 RETURN END PLA00820 SUBROUTINE FCT1(T, Y, DERY) PLA00830 IMPLICIT REAL+8(A-H, 0-Z) PLA00840 DIMENSION Y(1), DERY(1), TB(2), CW(2,2), WIN(2) PL A00850 COMMON DS, DI, ED, TI, TF, NC, IN, IM PLA00860 COMMON/F1/A, UL, TB, CW, WIN, URE PLA00870 COMMON/OUT/TP, TH1, THETA, ENR PLA00880 IF((TB(2).LT.TB(1)).AND.(T.GE.TB(1)))GO TO 4 PLA00890 IF(T.LT.TB(1))GO TO 2 PLA00900 IF(T.LT.TB(2))GO TO 3 PLA00910 ANTON CONTRACTOR CONTRACTOR STORES PLA00920 URE=U1 PLA00930 UIN=(TB(1)-TI+T-TB(2))=U1 PLA00940 GO TO 1 UIN-(T-TI)+UL PLA00950 2 A \* YEARD TA ANT - TOT - KETA \* FORA \* -URE-U1 PLA00960 PLA00970 GO TO 1 UIN=(T8(1)-TI)+U1 PL A00980 3 PLA00990 URE=0.00 LANGER PROVINT A CONTRACTOR AND A PROVINCE FOR THE ADDRESS AND A PROVINCE AND A P PLA01000 GO TO 1 UIN=(TB(1)-TI)+U1 PLA01010 URE=U1 PLA01020 THE TA= TH1+UIN PLA01030 ALL STATE AND DATESMATED ..... DERY(1)=A+DCUS(THETA)+Y(13) PLA01040 DERY(2) = A+DS IN(THETA)+Y(14) PLA01050 DERY(3)=DSIN(UIN) PLA01060 子教学学生学生了 PLA01070 DERY (4 )= DCOS (UIN) DERY(5)=DERY(1)+DERY(4) PLA01080 DERY (6) = DERY (2) = DERY (4) PLA01090 I IMAR ALLOGERING STROUGHER FREIDING DERY(7)=DERY(1)+DERY(3) PLA01100 そうしい 日かみませき ふうみ アイライル

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istered activity : Jainestersils annual dist THE BROWN BICENTENNIAL COMPUTER CENTER FILE: CPLANT FORTRAN PI DERY(8)=DERY(2)+DERY(3) PL A01110 
 DERY(8)=DERY(2)\*DERY(2)
 PLA01120

 DERY(9)=T\*DERY(3)
 PLA01120

 DERY(10)=T\*DERY(4)
 PLA01130

 DERY(11)=Y(1)
 PLA01140
 PLA01150 DERY(12)=Y(2) DERY(13)=CW(1,1)\*Y(13)+CW(1,2)\*Y(14) PLA01160 DERY(14)=CW(2,1)\*Y(13)+CW(2,2)\*Y(14) PLAJ1170 ENR=U1+UIN PLA01180 PLA01190 RETURN END PLA01200 a starter end of the provident of the second starter of the second 637 95 Ca soppores If Lalenches Pheterical Later States States and a state of the states of 2005年十五五十五年二十五年二月四月三月13 · 19月前一天东京近年中于王子上与中国的古口 MCNAG ASMU LIS. 0131144 to. + 101\* WALTANIMUNACT. AS NO. + 1030 TARBALINE, WILLARDE HUR BOY REMUTES TATAON AS 自己的意志不知道 DAL JANULTS, GIDTLER (石)来通信的工作法 1. 2016年,这种形式多名的资源后用生生于为了公司 出台资源的不足强

SUBROUTINE ESTM(X1,XF,EX,EA,EB)         ESTU           C         THE PURPUSE IS TO COMPUTE A LEAST SUUARE ESTIMATE OF PARACHUTE         ESTU           C         INPUT: INITIAL STATE'XI',FINAL STATE AND INTEGRATED VECTOR 'XF'         ESTU           C         UNTPUT: ESTIMATED HEADING 'EX';COEFF. VECTORS 'EA'L'EB'.         ESTO           C         UNTPUT: ESTIMATED HEADING 'EX';COEFF. VECTORS 'EA'L'EB'.         ESTO           C         INPLICIT REAL#0(A-H,O-Z)         ESTO           DIMENSION XII D.XF(1), EA(1), EA(1), FB(1), P(2,2), C(1(2), SI(2), P(2), PS(2), ESTO         ESTO           COMMON DIS, DITIN, EADD, TI,TF,NC,IN, IM, IPRI         ESTO           COMMON VDI'/TPR,THI,THE,ENN,ALP,RAMP         ESTO           COMMON/FZ/TEX         ESTO           EXTERNAL FC12,OUTP2         ESTO           C         COMMON/FZ/TEX         ESTO	CENTER
C THE POINDUSE IS TO CUMPUTE A LEAST SQUARE ESTIMATE OF PARACHUTE ESTO C THE POINDUSE IS TO CUMPUTE A LEAST SQUARE ESTIMATE OF PARACHUTE ESTO C HEADING AND COEFFICIENTS OF WIND COMPONENTS. INPLICIT REAL®D COEFFICIENTS OF WIND COMPONENTS. C UNTPUT: INITIAL STATE AND INTEGRATED VECTOR *XF* ESTO C UNTPUT: ESTIMATED HEADING 'EX';COEFF. VECTORS 'EA'&'&'EB'. C ESTO DIMENSION XI(1),XF(11),EA(1),EB(1),P(2,2),CI(2),SI(2),PC(2),PS(2),ESTO CO(2,2),WIN(2),CG(2,2),TB(2),TEX(2),DERY2(4),Y2(4),PRMT2(5),AUX2(8 ESTO C C,*),TEAC(3) C C,*),TEAC(3) C C,*),TEAC(3) C C,*),TEAC(3) C C,*),TEAC(3) C C,*),TEAC(3) C C,*),TEAC(3) C C,*,TEAC(3) C C,*,TE	0010
C HEADING AND COCPFICIENTS OF MIND COMPONENTS. HEADING AND COCPFICIENTS OF MIND COMPONENTS. INPUT: INITIAL STATE X1'*,FINAL STATE AND INTEGRATED VECTOR *XF* ESTO C UTUT: ESTIMATED HEADING 'EX*;COEFF. VECTORS 'EA*&*E6*. ESTO D IMPLICIT REAL*8(A-H,U-2) D IMPNSION XI(1),XF(1),EA(1),EB(1),P(2,2),C(1(2),S(12),P(2),PS(2),ESTO CO(2,2),WIN(2),C(1(2,2),T0(2),TEX(5),UERY2(4),Y2(4),PRHT2(5),AUX28 ESTO C (0,4),TEAC(3) C (0,4),TEAC(4),	0020
C NADUT: INITIAL STATE'X1', FINAL STATE AND INTEGRATED VECTOR 'XF' C UUTPUT: ESTIMATED HEADING 'EX'; CUEFF. VECTORS 'EA'&'ES'. C ESTO IMPLICIT REAL*86(A-H,U-Z) ESTO DIMENSION XI(1),XF(1),EA(1),EB(1),P(2,2),C(12),S1(2),PC(2),PS(2),ESTO C(2),2,1,WI(2),CA(2,2),T0(2),TEX(5),DERY2(4),Y2(4),PRMTZ(5),AUX2(8 ESTO C,3),TEXC(3) COMMON UUT2),CA(2,2),T0(2),TEX(5),DERY2(4),Y2(4),PRMTZ(5),AUX2(8 ESTO C,3),TEXC(3) COMMON/UUT/TPR,THI,THE,ENR,ALP,RAMP COMMON/UUT/TPR,THI,THE,ENR,ALP,RAMP COMMON/UT7/TEX EXTERNAL FC12,OUTP2 C COMMON/F1/V,U19,CG,WI(N,UP,OEG,TEXC,PI,CV C COMMON/F1/V,U19,CG,WI(N,UP,OEG,TEXC,PI,CV C COMMON/F1/V,U19,CG,WI(N,UP,OEG,TEXC,PI,CV C COMMON/F1/V,U19,CG,WI(N,UP,OEG,TEXC,PI,CV C C COMMON/F1/V,U19,CG,WI(N,UP,OEG,TEXC,PI,CV C C C C C C C C C C C C C C C C C C C	0030
C UNFUT: ESTIMATED HEADING 'EX'; COEFF. VECTURS 'EA'L'ED'. ESTO C ESTO C ESTO C ESTO C ESTO C DIMENSION XI(1), KF(1), FA(1), FB(1), FD(2), SI(2), FC(2), FS(2), ESTO C C(2), 2), wIN(2), CA(2, 2), TB(2), TEX(5), JOERY2(4), Y2(4), PRHT2(5), AUX2(8) ESTO C C(2), 1, wIN(2), CA(2, 2), TB(2), TEX(5), JOERY2(4), Y2(4), PRHT2(5), AUX2(8) ESTO C C(4), TEX(13) C C(4), TEX(13) C C(4), TEX(13) C C(4), TEX(13) C COMMON/DUT/TPR, THI, THE, FUN, ALP, RAMP C COMMON/DUT/TPR, THI, THE, FUN, ALP, RAMP C COMMON/F2/TEX EXTERNAL FCI2, OUTP2 C C COMPUTE THE ESTIMATED HEADING 'EX' C COMPUTE THE STIMATED HEADING 'EX' C CONTINUE P (12)=XF(10) S (12)=XF(10) S (12)=XF(10) S (12)=XF(10) C (12)=XF(10) C (12)=XF(10) C (12)=XF(10) C (12)=XF(10) C (12)=XF(10) C (12)=XF(10) C (11)=XF(2) C (11)=	0060
C 001PD11 ESTIMATED READING 'EA', COEPP. VECTORS 'EA'CCES'. ESTO ESTO IMPLICIT REAL=86(A-H,G-Z) IMPLICIT REAL=86(A-H,G-Z) COLORD X1(1),XF(1),EA(1),EB(1),P(2,2),C(12),S1(2),PC(2),PS(2),ESTO COLORD X1(1),XF(1),ERD,TI,TF,NC,IN,IM,IPPI COMMON/F1/Y,U,TPA,TH,TH,E,ENR,ALP,RAMP COMMON/F1/Y,U,TPA,TH,TH,E,ENR,ALP,RAMP COMMON/F1/Y,U,TPA,CH,MINUP,OEG,TEXC,PI,CV COMMON/F1/Y,U,TPA,CH,MINUP,OEG,TEXC,PI,CV COMMON/F1/Y,U,TPA,CH,MINUP,OEG,TEXC,PI,CV COMMON/F1/Y,U,TPA,TH,TH,E,ENR,ALP,RAMP COMMON/F1/Y,U,TPA,TH,TH,E,ENR,ALP,RAMP COMMON/F1/Y,U,TPA,CH,MINUP,OEG,TEXC,PI,CV COMMON/F1/Y,U,TPA,CH,MINUP,OEG,TEXC,PI,CV COMMON/F1/Y,U,TPA,TH,TH,E,ENR,ALP,RAMP COMMON/F1/Y,U,TPA,TH,TH,E,ENR,ALP,RAMP COMMON/F1/Y,U,TPA,TH,TH,E,ENR,ALP,RAMP COMMON/F1/Y,U,TPA,TH,TH,E,ENR,ALP,RAMP COMMON/F1/Y,U,TPA,TH,TH,E,ENR,ALP,RAMP COMMON/F1/Y,U,TPA,TH,TH,E,ENR,ALP,RAMP COMMON/F1/Y,U,TPA,TH,TH,E,ENR,ALP,RAMP COMMON/F1/Y,U,TPA,TH,TH,E,ENR,ALP,RAMP COMMON/F1/Y,U,TPA,TH,TH,E,ENR,ALP,RAMP COMMON/F1/Y,U,TPA,TH,TH,E,ENR,ALP,RAMP COMMON/F1/Y,U,TPA,TH,TH,E,ENR,ALP,RAMP COMPUTE THE ESTIMATED HEADING 'EX' C COMPUTE THE ESTIMATED 'EX' C COMPUTE THE ESTIMATED 'EXT' C COMPUTE THE ESTIMATED 'EX' C COMPUTE THE ESTIMATE 'EX' C COMPUTE THE ESTIMATED 'EX' C COMPUTE THE ESTIMATED 'EX' C COMPUTE THE ESTIMATED 'EX' C COMPUTE THE ESTIMATED	0050
C (14) C (22,2) + (14) + (1)	0050
L HMPLICIT REAL#8(A-H,U-2) DIMEMSION XI(1),XF(1),EA(1),EB(1),P(2,2),CI(2),SI(2),PC(2),PS(2),ESTO CD1MEMSION XI(1),XF(1),EA(1),EB(1),P(2,2),CI(2),SI(2),PC(2),PS(2),ESTO CD4MON JTES,DTIN,ERDD,TI,TF,NL,IN,IN,IPRI COMMON/FLX,U2,CA(2,2),T8(2),JEX(5),DEX(2(4),Y2(4),PRMT2(5),AUX2(6) ESTO COMMON/FLX,U1,FR,CHD,TI,TF,NL,IN,IN,IPRI ESTO COMMON/FLX,U1,FR,CH,MI,UP,DEG,TEXC,PI,CV COMMON/FLX,U,U,TB,CH,MI,UP,DEG,TEXC,PI,CV COMMON/FLX,UT,TB,CH,MI,UP,DEG,TEXC,PI,CV ESTO COMMON/FLX,UT,TB,CH,MI,UP,DEG,TEXC,PI,CV ESTO COMMON/FLX,UT,TB,CH,MI,UP,DEG,TEXC,PI,CV ESTO COMMON/FLX,UT,TB,CH,MI,UP,DEG,TEXC,PI,CV ESTO COMMON/FLX,UT,TB,CH,MI,UP,DEG,TEXC,PI,CV ESTO COMMON/FLX,UT,TB,CH,MI,UP,DEG,TEXC,PI,CV ESTO COMMON/FLX,UT,TB,CH,MI,UP,DEG,TEXC,PI,CV ESTO COMMON/FLX,UT,TB,CH,MI,UP,DEG,TEXC,PI,CV ESTO COMMON/FLX,UT,TB,CH,MI,UP,DEG,TEXC,PI,CV ESTO COMMON/FLX,UT,TB,CH,MI,UP,DEG,TEXC,PI,CV ESTO COMMON/FLX,UT,TB,CH,MI,UP,DEG,TEXC,PI,CV ESTO COMMON/FLX,UT,TB,CH,MI,UP,DEG,TEXC,PI,CV ESTO COMOUTE THE ESTIMATED HEADING 'EX' C C COMPUTE THE ESTIMATED HEADING 'EX' C C (11)=XF(1)-XI(1), P(1,2)=TFXF(2)-TI=XI(2)-XF(12) P(2,2)=TFXF(2)-TI=XI(2)-XF(12) C (11)=XF(3) P(1)=X	0080
IMPLICIT KEALWOIA-M.U-21       ESIO         OTHENSION XILID,XF(1), GA(1,2), DERY2(4), Y2(4), PRM72(5), AUX2(6)       ESTO         CQ42,2),WIN(2),CG(2,2), TB(2), TEX(5), UERY2(4), Y2(4), PRM72(5), AUX2(6)       ESTO         CQMMON DTES, DITN,E ROD, TI,TF,NL,IN,IN,IPRI       ESTO         COMMON/FLVY,U,TB,CAWIN,UP,OEG,FEXC,PI,CV       ESTO         COMMON/FLVY,U,TB,CAWIN,UP,OEG,FEXC,PI,CV       ESTO         COMMON/FLVY,U,TB,CAWIN,UP,OEG,FEXC,PI,CV       ESTO         COMMON/FLVY,U,TB,CAWIN,UP,OEG,FEXC,PI,CV       ESTO         CUMMON/F2/TEX       ESTO         EXTERNAL FCT2,OUTP2       ESTO         C       ESTO         C       COMPUTE THE ESTIMATED HEADING 'EX*         C       ESTO         P(1,1)=XF(1)-XI(1)       ESTO         P(2,1)=XF(2)-TI*XI(1)-XF(11)       ESTO         P(2,1)=XF(4)-TI*XI(1)-XF(12)       ESTO         C(11)=XF(4)       ESTO         C(11)=XF(4)       ESTO         C(11)=XF(5)       ESTO         P(2)=XF(6)       ESTO         P(1)=XF(5)       ESTO         P(1)=XF(4)       ESTO         C(1)=XF(5)       ESTO         P(2)=XF(6)       ESTO         P(2)=XF(6)       ESTO         D(1)=XF(5)       ESTO     <	0000
01MEMBILUM X111),XF(12),XF(12),FEX(3),DERY2(4),PRMT2(5),AUX2(6)         CQ12,21,WIN(2),CG(22),T6X(3),DERY2(4),PRMT2(5),AUX2(6)         CQMMON JUT7,FR,THI,FHE,ENR,ALP,RAMP         COMMON/DUT7,FR,THI,THE,ENR,ALP,RAMP         COMMON/F1/V,U,T8,CW,WIN,UP,OEG,TEX(5,PI,CV         COMMON/F1/V,U,T8,CW,WIN,UP,OEG,TEX(5,PI,CV         COMMON/F1/V,U,T8,CW,WIN,UP,OEG,TEX(5,PI,CV         COMMON/F1/V,U,T8,CW,WIN,UP,OEG,TEX(5,PI,CV         COMMON/F1/V,U,T8,CW,WIN,UP,OEG,TEX(5,PI,CV         COMMON/F1/V,U,T8,CW,WIN,UP,OEG,TEX(5,PI,CV         COMMON/F1/V,U,T8,CW,WIN,UP,OEG,TEX(5,PI,CV         COMMON/F1/V,U,T8,CW,WIN,UP,OEG,TEX(5,PI,CV         COMMON/F1/V,U,T8,CW,WIN,UP,OEG,TEX(5,PI,CV         COMMON/F1/V,U,T8,CW,WIN,UP,OEG,TEXC,PI,CV         COMMON/F1/V,U,T8,CW,WIN,UP,OEG,TEXC,PI,CV         COMMON/F1/V,U,T8,CW,WIN,UP,OEG,TEXC,PI,CV         COMMON/F1/V,U,T8,CW,WIN,UP,OEG,TEXC,PI,CV         COMMON/F1/V,U,T8,CW,WIN,UP,OEG,TEXC,PI,CV         COMMON/F1/V,U,T8,CW,WIN,UP,OEG,TEXC,PI,CV         COMMON/F1/V,UT8,CW,WIN,UP,OEG,TEXC,PI,CV         COMMON/F1/V,UT8,CW,WIN,UP,OEG,TEXC,PI,CV         COMMON/F1/V,UT8,CW,WIN,UP,OEG,TEXC,PI,CV         COMINACAF(1)-FX1(1)         FILE         COMINACAF(1)-FX1(1)         COMINACAF(1)-FX1(1)         COMINACAF(6)         COMINACAF(6)-XF(7)-(P(2,1)*XF(4)-P(1,1)*XF(3))/OTES	0080
CD(2,2) w IN(2),CW(2,2), IB(2), JER(3), JER(2(4), V2(4), PRH(2(5), AUA218 ESTO COMMON DTES, DTIN, ERBD, TI, TF, NC, IN, IM, IPRI COMMON/JTPR, THI, THE, ERA, ALP, RAMP COMMON/F1/V, U, TB, CW, WIN, UP, OEG, TEXC, PI, CV ESTO COMMON/F2/TEX EXTERNAL FC72, OUTP2 C C COMPUTE THE EST IMATED HEADING 'EX' C COMPUTE THE EST IMATED HEADING 'EX' C COMPUTE THE STI IMATED HEADING 'EX' C CONTINUE STID C C CONTINUE C C CONTINUE C C CONTINUE C C CONTINUE C C CONTINUE C C CONTINUE C C C CONTINUE C C C C CONTINUE C C C C C C C C C C C C C C C C C C C	0090
C,4), FEX.(3) COMMON JUES, DTIN, ERBD, TI, TF, NC, IN, IM, IPRI COMMON/UUT/TPR, THI, THE, ENR, ALP, RAMP COMMON/F1/Y, U, TB, CU, WIN, UP, DEG, TEXC, PI, CV COMMON/F2/TEX EXTERNAL FCT2, OUTP2 C C COMPUTE THE ESTIMATED HEADING 'EX' C P(1, 1)=XF(1)-XI(1) P(1, 2)=TFXXF(1)-TI*XI(1)-XF(11) P(1, 2)=TFXXF(2)-TI*XI(2)-XF(12) C (1)=XF(2)-XI(2) P(2, 2)=TFXXF(2)-TI*XI(2)-XF(12) C (1)=XF(4) C (1)=XF(4)	0100
COMMON DIES, DIIN, ENDO, II, IF, NC, IN, IN, IPAI COMMON/DI/TPA, THI, THE, ENR, ALP, RAMP COMMON/F1/V, U, TB, CW, WIN, UP, DEG, TEXC, PI, CV ESTO CUMMON/F2/TEX EXTERNAL FCT2, OUTP2 C C COMPUTE THE EST IMATED HEADING 'EX' C COMPUTE THE EST IMATED HEADING 'EX' C COMPUTE THE STIMATED HEADING 'EX' C CONPUTE THE STIMATED HEADING 'EX' C CONTINUE S STO S STO	0110
COMMON/JUT/TPR.THI.THE.ENR.ALP.RAMP COMMON/F2/TEX EXTERNAL FCT2.OUTP2 EXTERNAL FCT2.OUTP2 C C COMPUTE THE ESTIMATED HEADING 'EX' C C COMPUTE THE ESTIMATED HEADING 'EX' C P(1,1)=XF(1)-XI(1) P(1,2)=TF*XF(1)-T1*XI(1)-XF(11) P(1,2)=TF*XF(1)-T1*XI(1)-XF(11) P(1,2)=TF*XF(2)-T1*XI(2)-XF(12) C (1(1)=XF(2)-XF(12) ESTO C (1(1)=XF(4) C (1(1)=XF(4) C (1(1)=XF(4) C (1(1)=XF(5) P(1)=XF(5) P(1)=XF(5) P(1)=XF(5) P(1)=XF(6) C (1)=XF(6) C (1)=XF(5) C (1)=XF(6) C (1)=XF(6) C (1)=XF(6) C (1)=XF(7) C (1)=XF(7) C (1)=XF(7) C (1)=XF(6) C (1)=XF(7) C	0120
COMMON/F1/V.0.TB.CW.WIN, UP.DEG.TEXC.P1.CV CUMMON/F2/TEX EXTERNAL FCT2.OUTP2 C C C COMPUTE THE ESTIMATED HEADING "EX" C P(1.1)=XF(1)-XI(1). P(1.2)=TF*XF(1)-T1*X1(1)-XF(11) P(2.2)=TF*XF(2)-T1*X1(2)-XF(12) P(2.2)=TF*XF(2)-T1*X1(2)-XF(12) C(1)=XF(2)-T1*XI(2)-XF(12) C(1)=XF(4) C(1)=XF(3) SI(2)=XF(3) SI(2)=XF(3) P(1)=XF(5) P(1)=XF(5) P(1)=XF(5) P(1)=XF(6) P(1)=XF(6) P(1)=XF(6) P(1)=XF(6) C(1)=XF(6) P(1)=XF(6) P(1)=XF(6) C(1)=XF(6) P(1)=XF(6) P(1)=XF(6) C(1)=XF(6) P(1)=XF(6) C(1)=XF(6) P(1)=XF(6) P(1)=XF(6) P(1)=XF(6) P(1)=XF(6) P(1)=XF(6) C(1)=XF(6) P(1)=XF(6) C(1)=XF(6) P(1)=	0130
COMMON /F2/TEX ESTO EXTERNAL FCT2,OUTP2 ESTO C COMPUTE THE ESTIMATED HEADING "EX" ESTO C (COMPUTE THE ESTIMATED HEADING "EX" ESTO P(1,1)=XF(1)-XI(1) (D)=XF(11) ESTO P(1,2)=TF*XF(1)-T1*XI(1)-XF(11) ESTO P(1,2)=TF*XF(2)-T1*XI(2)-XF(12) ESTO C1(1)=XF(4) ESTO C1(1)=XF(4) ESTO S1(1)=XF(3) ESTO P(1)=XF(3) ESTO P(1)=XF(5) ESTO P(1)=XF(5) ESTO P(1)=XF(7) ESTO P(1)=XF(7) ESTO D(1,1)=XF(7) ESTO ESTO D(1,1)=XF(7) ESTO ESTO D(1,1)=XF(7) ESTO ESTO D(1,1)=XF(7) ESTO ESTO D(1,2)=-CO RMD=0.DO RMD=0.DO RMD=0.DO RMD=0.DO RMD=0.DO RMD=0.DO ESTO D(1,1)=XF(2)=FS(1)=RMD UMER=PC(1)=PS(1)=RMD ESTO	0140
EXTERNAL FCT2, OUTP2 C COMPUTE THE ESTIMATED HEADING 'EX' C FORMUTE THE ESTIMATED HEADING 'EX' P(1,1)=XF(1)-XI(1) P(1,2)=TF*XF(1)-T1*XI(1)-XF(11) P(2,1)=XF(1)-XI(2) P(2,2)=TF*XF(2)-T1*XI(2)-XF(12) C (11)=XF(4) C (11)=XF(4) C (11)=XF(4) C (11)=XF(5) P(2)=XF(6) P(2)=XF(6) P(2)=XF(6) P(2)=XF(6) P(2)=XF(6) P(2)=XF(6) P(2)=XF(6) P(2)=XF(6) P(2)=XF(6) P(2)=XF(6) P(2)=XF(6) P(2)=XF(6) P(2)=XF(6) P(2)=XF(6) P(2)=XF(6) P(2)=XF(6) P(2)=XF(7)	0150
C COMPUTE THE ESTIMATED HEADING 'EX' C F(1,1)=XF(1)-XI(1) P(1,2)=TF*XF(1)-T1*XI(1)-XF(11) P(2,1)=XF(2)-XI(2) P(2,1)=XF(2)-XI(2) P(2,2)=TF*XF(1)-T1*XI(2)-XF(12) C(11)=XF(2)-XI(2)-XF(12) C(11)=XF(2)-XI(2)-XF(12) C(11)=XF(4) C(11)=XF(3) S(2)=XF(4) P(	0160
C COMPUTE THE ESTIMATED HEADING "EX" C ESTO P(1,1)=XF(1)-XI(1) P(1,2)=TF*XF(1)-T1*XI(1)-XF(11) P(2,1)=XF(2)-XI(2) P(2,2)=TF*XF(2)-T1*XI(2)-XF(12) C1(1)=XF(4) C1(1)=XF(4) C1(1)=XF(5) P(1)=XF(5) P(1)=XF(5) P(1)=XF(5) P(1)=XF(6) P(1)=XF(6) P(1)=XF(6) P(1)=XF(6) P(1)=XF(6) P(1)=XF(6) C1(2)=XF(6) P(1)=XF(7) P(1)=X	0170
C (ESTO P(1,1)=XF(1)-XI(1), (ESTO P(1,2)=TF*XF(1)-T1*XI(1)-XF(11), (ESTO P(2,1)=XF(2)-XI(2), (ESTO P(2,2)=TF*XF(2)-T1*XI(2)-XF(12), (ESTO C(1)=XF(4), (ESTO C(1)=XF(4), (ESTO S(1)=XF(3), (ESTO P(1)=XF(3), (ESTO P(1)=XF(5), (ESTO P(1)=XF(6), (ESTO P(1)=XF(6), (ESTO P(1)=XF(6), (ESTO P(1)=XF(6), (ESTO DMC=XF(5)+XF(8)-(P(1,1)*XF(3))/DTES, (ESTO DMC=XF(5)+XF(8)-(P(1,1)*XF(4)+P(1,1)*XF(3))/DTES, (ESTO DMC=XF(5)+XF(8)-(P(1,1)*XF(4)+P(1,1)*XF(3))/DTES, (ESTO DMC=XF(5)+XF(8)-(P(1,1)*XF(4)+P(1,1)*XF(3))/DTES, (ESTO DMC=XF(5)+XF(8)-(P(1,1)*XF(4)+P(1,1)*XF(3))/DTES, (ESTO D(1,1)=-0,00*SO+(TF+T1), (ESTO D(1,1)=-0,00*SO=(TF+T1), (ESTO D(1,2)=-1,2,00*SO, (ESTO D(1,2)=-0,00*SO, (ESTO D(1,2)=-0,00*SO, (ESTO D(1,2)=-0,00*SO, (ESTO D(1,2)=-0,00*SO, (ESTO D(1,2)=-0,00*SO, (ESTO C(1)=XF(2)=XF(2,1)*CI(1)+P(1,1)*SI(1)), (ESTO RMD=0,00, (ESTO RMD=0,00, (ESTO D(0,1)=X+2, (ESTO C(0,1)=X+2, (ESTO C(1)=X+2, (E	0180
P(1,1)=XF(1)-XI(1)       ESTO         P(1,2)=TF*XF(1)-T1*XI(1)-XF(11)       ESTO         P(2,1)=XF(2)-XI(2)       ESTO         P(2,2)=TF*XF(2)-T1*XI(2)-XF(12)       ESTO         CI(1)=XF(4)       ESTO         CI(1)=XF(4)       ESTO         CI(2)=XF(10)       ESTO         SI(1)=XF(3)       ESTO         P(1)=XF(5)       ESTO         P(1)=XF(6)       ESTO         P(1)=XF(7)       ESTO         PS(1)=XF(7)       ESTO         PS(1)=XF(7)       ESTO         DMC=XF(5)-XF(7)-(P(2,1)*XF(4)-P(1,1)*XF(3))/DTES       ESTO         DMC=XF(5)-XF(7)-(P(2,1)*XF(4)-P(1,1)*XF(3))/DTES       ESTO         DMC=XF(5)-XF(7)-(P(2,1)*XF(4)-P(1,1)*XF(3))/DTES       ESTO         DMC=XF(5)-XF(7)-(P(2,1)*XF(4)-P(1,1)*XF(3))/DTES       ESTO         DMC=XF(5)-XF(7)-(P(2,1)*XF(4)-P(1,1)*XF(3))/DTES       ESTO         DMC=XF(5)-XF(7)-(P(1,1)*XF(4)-P(1,1)*XF(3))/DTES       ESTO         D(1,1)=4,DO*SD*(TF+T1)       ESTO         D(1,1)=4,DO*SD*(TF+T1)       ESTO         D(1,2)=2)       ESTO       ESTO         D(1,2)=12,DO*SD       ESTO       ESTO         D(1,2)=12,DO*SD       ESTO       ESTO         RMD=0.DO       ESTO       ESTO      <	0190
P(1,2)=TF*XF(1)-T1*X1(1)-XF(11) P(2,1)=XF(2)-XI(2) P(2,1)=XF(2)-T1*X1(2)-XF(12) C1(1)=XF(4) C1(1)=XF(4) C1(1)=XF(4) C1(2)=XF(10) S1(1)=XF(3) P(2)=XF(3) P(2)=XF(6) P(2)=XF(6) P(2)=XF(6) P(2)=XF(7) P(2)=XF(7) P(2)=XF(7) P(2)=XF(7)-(P(2,1)*XF(4)-P(1,1)*XF(3))/OTES ESTO UMRC=XF(6)-XF(7)-(P(2,1)*XF(4)-P(1,1)*XF(3))/OTES ESTO UMRC=XF(6)-XF(7)-(P(2,1)*XF(4)-P(1,1)*XF(3))/OTES ESTO DMC=XF(6)-XF(7)-(P(2,1)*XF(4)-P(1,1)*XF(3))/OTES ESTO DMC=XF(6)-XF(7)-(P(2,1)*XF(4)-P(1,1)*XF(3))/OTES ESTO DMC=XF(6)-XF(7)-(P(2,1)*XF(4)-P(1,1)*XF(3))/OTES ESTO DMC=XF(6)-XF(7)-(P(2,1)*XF(4)-P(1,1)*XF(3))/DTES ESTO D(1,2)=-6.000*SD*(TF+T1+T1*2) D(2,2)=12.00*SD 1F(ENR.1T.0EG)GO TO 24 RMD=0.D0 RMJ=0.D0 RMJ=0.D0 CONTINUE CO	0200
P(2,1)=xF(2)-xI(2)       ESTO         P(2,2)=TF*xF(2)-TI*xI(2)-xF(12)       ESTO         CI(1)=xF(4)       ESTO         CI(2)=xF(10)       ESTO         SI(1)=xF(3)       ESTO         PC(1)=xF(5)       ESTO         PC(1)=xF(7)       ESTO         PS(2)=xF(6)       ESTO         DMC=xF(6)-xF(7)-(P(2,1)*xF(4)-P(1,1)*xF(3))/DTES       ESTO         DMC=xF(6)-xF(7)-(P(2,1)*xF(4)+P(2,1)*xF(3))/DTES       ESTO         DMC=xF(6)-xF(7)-(P(2,1)*xF(4)+P(2,1)*xF(3))/DTES       ESTO         DMC=xF(6)-xF(7)-(P(2,1)*xF(4)+P(2,1)*xF(3))/DTES       ESTO         DMC=xF(6)-xF(7)-(P(2,1)*xF(4)+P(2,1)*xF(3))/DTES       ESTO         DMC=xF(6)-xF(7)-(P(2,1)*xF(4)+P(2,1)*xF(3))/DTES       ESTO         DMC=xF(5)-xF(7)-(P(2,1)*xF(4)-P(1,1)*xF(3))/DTES       ESTO         D(1,1)=-4.00*SO*(TF+T1)       ESTO         D(1,2)=-6.00*SO       ESTO         IF(ENR.LT.DEGIGU TO 24       ESTO         RMD=0.00       ESTO         D(1,2)=-12.00*SO       ESTO         D(2,2)=-12.00*SO       ESTO         RMD=0.00       ESTO         RMD=0.00       ESTO         D(2,00       ESTO         D(2,00       ESTO         RMD=0.00       ESTO         <	0210
P(2, 2)=TF#XF(2)-T1*XI(2)-XF(12)       ESTO         C1(1)=XF(4)       ESTO         C1(2)=XF(10)       ESTO         S1(1)=XF(3)       ESTO         PC(1)=XF(5)       ESTO         PC(1)=XF(6)       ESTO         PS(2)=XF(8)       ESTO         UMRC=XF(6)-XF(7)-(P(2,1)*XF(4)-P(1,1)*XF(3))/DTES       ESTO         DMC=XF(5)+XF(8)-(P(1,1)*XF(4)+P(2,1)*XF(3))/DTES       ESTO         DMC=XF(5)+XF(8)-(P(1,1)*XF(4)+P(2,1)*XF(3))/DTES       ESTO         DMC=XF(5)+XF(8)-(P(1,1)*XF(4)+P(2,1)*XF(3))/DTES       ESTO         DMC=XF(5)+XF(8)-(P(1,1)*XF(4)+P(2,1)*XF(3))/DTES       ESTO         DMC=XF(5)+XF(8)-(P(1,1)*XF(4)+P(2,1)*XF(3))/DTES       ESTO         DMC=XF(5)+XF(8)-(P(1,1)*XF(4)+P(2,1)*XF(3))/DTES       ESTO         DMC=XF(5)+XF(8)       ESTO         DMC=XF(5)+XF(8)       ESTO         DMC=XF(5)+XF(8)       ESTO         D(1,1)=XF(7)       ESTO         D(1,2)==0.00*SD       ESTO         D(2,2)=12.00*SD       ESTO         IF(ENR.IT.026JGU TO 24       ESTO         RMJ=RM0+O(1,J)#(P(1,J)*C1(1)+P(1,J)#S1(1))       ESTO         OO 7 J=1,2       ESTO         RMU=RM0+O(1,J)#(P(1,J)*C1(1)+P(1,J)#S1(1))       ESTO         CONTINUE       ESTO	0220
C1(1)=xF(4) C1(2)=xF(10) S1(1)=xF(3) S1(1)=xF(3) P(1)=xF(5) P(1)=xF(6) PS(2)=xF(6) PS(2)=xF(6) C1)=xF(7) PS(2)=xF(8) UMRC=xF(6)-xF(7)-(P(2,1)=xF(4)-P(1,1)=xF(3))/DTES ESTO DMC=xF(6)-xF(7)-(P(2,1)=xF(4)-P(1,1)=xF(3))/DTES ESTO DMC=xF(6)-xF(7)-(P(2,1)=xF(4)-P(1,1)=xF(3))/DTES ESTO DMC=xF(6)-xF(7)-(P(2,1)=xF(4)-P(1,1)=xF(3))/DTES ESTO DMC=xF(6)-xF(7)-(P(2,1)=xF(4)-P(1,1)=xF(3))/DTES ESTO DMC=xF(6)-xF(7)-(P(2,1)=xF(4)-P(1,1)=xF(3))/DTES ESTO D(1,1)=4.D0=xD=(TF=T1) D(2,2)=12.D0=xD IF(ENR.LT-DEG)GU TO 24 RMD=0.D0 RMD=0.D0 RMD=0.D0 RMD=0.D0 CON TINUE CON	0230
C1(2)=XF(10) S1(1)=XF(3) S1(2)=XF(3) PC(1)=XF(5) PC(2)=XF(6) PS(1)=XF(7) PS(2)=XF(6) UMRC=XF(6)-XF(7)-(P(2,1)*XF(4)-P(1,1)*XF(3))/DTES ESTO DMC=XF(5)-XF(7)-(P(2,1)*XF(4)-P(1,1)*XF(3))/DTES ESTO DMC=XF(5)-XF(7)-(P(2,1)*XF(4)-P(1,1)*XF(3))/DTES ESTO DMC=XF(5)-XF(7)-(P(2,1)*XF(4)-P(1,1)*XF(3))/DTES ESTO DMC=XF(5)-XF(7)-(P(2,1)*XF(4)-P(1,1)*XF(3))/DTES ESTO D(1,1)=4.00*SD*(TF+*TI+TI**2) C11,1)=4.00*SD*(TF+*TI+TI**2) C11,2)=-6.00*SD*(TF+TI) C12,2)=12.00*SD 1F(ENR.LT.0EG)GU T0 24 RMJ=0.D0 RMJ=0.D0 C0 7 J=1,2 RMU=RMU+D(1,J)*(P(2,J)*CI(1)-P(1,J)*SI(1)) RM0=RMD+D(1,J)*(P(1,J)*CI(1)+P(2,J)*SI(1)) C0 CONTINUE C0 CONTINUE C1 +PS(2)-RMD WARTE(6,27) UMER, DENOM ESTO 27 FURMAT(1H, *NUMERATOR= *,D14.8,2X,*DENUM INATOR= *,D14.8) ESTO ESTO C1 + 2 + 2 + 2 + 2 + 2 + 2 + 2 + 2 + 2 +	0240
SI(1)=xF(3)       ESTO         SI(2)=xF(6)       ESTO         PC(1)=xF(6)       ESTO         PS(1)=xF(7)       ESTO         PS(1)=xF(7)       ESTO         UMRC=xF(6)-xF(7)-(P(2,1)*xF(4)-P(1,1)*xF(3))/DTES       ESTO         DMC=xF(5)-xF(7)-(P(2,1)*xF(4)-P(1,1)*xF(3))/DTES       ESTO         DMC=xF(5)-xF(7)-(P(2,1)*xF(4)-P(1,1)*xF(3))/DTES       ESTO         DMC=xF(5)-xF(7)-(P(2,1)*xF(4)-P(1,1)*xF(3))/DTES       ESTO         DMC=xF(5)-xF(7)-(P(2,1)*xF(4)-P(1,1)*xF(3))/DTES       ESTO         DMC=xF(5)-xF(7)-(P(2,1)*xF(4)-P(1,1)*xF(3))/DTES       ESTO         DU(1,1)=4-D0+SD*(TF*TI)       ESTO         D(1,1)=4-D0+SD*(TF*TI)       ESTO         D(1,2)=-6-0.0=SD*(TF*TI)       ESTO         D(1,2)=-6.00=SD       ESTO         D(1,2)=-0.0=SD*(TF*TI)       ESTO         D(1,2)=-0.0=SD*(TF*TI)       ESTO         D(1,2)=-1.2       ESTO         D(2,2)=12.00*SD       ESTO         RMD=0.0       ESTO         RMD=0.0       ESTO         RMD=0.0       ESTO         RMD=RMO+D(1,J)*(P(2,J)*CI(1)+P(1,J)*SI(1))       ESTO         RMD=RMO+D(1,J)*(P(1,J)*(CI(1)+P(2,J)*SI(1))       ESTO         OENOM=PC(1)+PS(2)=RMD       ESTO         UMER=DENOM	0250
SI (2)=xF(9)       ESTO         PC(1)=xF(5)       ESTO         PC(2)=xF(6)       ESTO         PS(2)=xF(8)       ESTO         UMRC=xF(5)+xF(8)-(P(1,1)*xF(4)-P(1,1)*xF(3))/DTES       ESTO         DMC=xF(5)+xF(8)-(P(1,1)*xF(4)+P(2,1)*xF(3))/DTES       ESTO         SU=1.00/UTES**3       ESTO         D(1,1)=4.D0*S0*(TF**2+TF*TI+TI**2)       ESTO         D(1,2)=-6.U0*S0*(TF+*1)       ESTO         D(2,1)=0(1,2)       ESTO         D(2,2)=12.00*SD       ESTO         If(ERK_LT.0EG)GU TO 24       ESTO         RMD=0.DO       ESTO         00 6 1=1,2       ESTO         00 7 J=1,2       ESTO         00 7 J=1,2       ESTO         01 7 CONTINUE       ESTO         01 8 CONTINUE       ESTO         01 9 CONTINUE       ESTO         02 7 FURMAT(IM, *NUMERATOR= *,014.8,2x,*DENUM INATOR= *,014.8)       ESTO         27 FURMAT(IM, *NUMERATOR= *,014.8,2x,*DENUM INATOR= *,014.8)       ESTO	0260
PC(1)=xF(5)       ESTO         PC(2)=xF(6)       ESTO         PS(1)=xF(7)       ESTO         PS(2)=xF(6)       ESTO         UMRC=xF(6)-xF(7)-(P(2,1)+xF(4)-P(1,1)+xF(3))/DTES       ESTO         DMC=xF(5)+xF(8)-(P(1,1))+xF(4)+P(2,1)+xF(3))/DTES       ESTO         DMC=xF(5)+xF(8)-(P(1,1))+xF(4)+P(2,1)+xF(3))/DTES       ESTO         DMC=xF(5)+xF(8)-(P(1,1))+xF(4)+P(2,1)+xF(3))/DTES       ESTO         DMC=xF(5)+xF(8)-(P(1,1))+xF(3))/DTES       ESTO         DU(1,2)=-6.00*SD+(TF+T1)       ESTO         D(1,2)=-10.00*SD       ESTO         D(2,1)=0(1,2)       ESTO         D(2,2)=12.00*SD       ESTO         D(2,2)=12.00*SD       ESTO         D(2,2)=12.00*SD       ESTO         D(2,2)=12.00*SD       ESTO         D(2,2)=12.00*SD       ESTO         D(2,2)=12.00*SD       ESTO         RMD=0.00       ESTO         RMJ=0.00       ESTO         RMJ=0.00       ESTO         RMJ=0.00       ESTO         RMD=RMD+0(1,J)+(P(2,J)+CI(1)-P(1,J)+SI(1))       ESTO         RMD=RMD+0(1,J)+(P(1,J)+CI(1)+P(2,J)+SI(1))       ESTO         RMD=RMD+0(1,J)+(P(1,J)+CI(1)+P(2,J)+SI(1))       ESTO         OCONTINUE       ESTO <td< td=""><td>0270</td></td<>	0270
PC(2)=xF(6)       ESTO         PS(1)=xF(7)       ESTO         PS(2)=xF(8)       ESTO         UMRC=xF(6)-xF(7)-(P(2,1)*xF(4)-P(1,1)*xF(3))/DTES       ESTO         DMC=xF(5)+xF(8)-(P(1,1)*xF(4)+P(2,1)*xF(3))/DTES       ESTO         SU=1.DO/DTES*3       ESTO         D(1,1)=4.D0*SD*(TF*T2+TF*T1+T1**2)       ESTO         D(1,2)=-6.U0*SD*(TF+T1)       ESTO         D(2,1)=D(1,2)       ESTO         D(2,2)=12.D0*SD       ESTO         IF(ENR.LT.DEG)GU TO 24       ESTO         RMU=0.DO       ESTO         D0 7 J=1,2       ESTO         RMU=RMU+D(1,J)*(P(2,J)*CI(1)-P(1,J)*SI(1))       ESTO         RMD=RMD+D(1,J)*(P(2,J)*CI(1)+P(2,J)*SI(1))       ESTO         CONTINUE       ESTO         CONTINUE       ESTO         UMER=PC(2)-PS(1)-RMU       ESTO         DENOM=PC(1)+PS(2)-RMO       ESTO         wkITE(6,27) UMER, DENOM       ESTO         EX =0A TAN2(UMER, OE NUM)       ESTO         EX =0A TAN2(UMER, OE NUM)       ESTO	0280
PS(1)=xF(7)       ESTO         PS(2)=xF(8)       ESTO         UMRC=xF(6)-xF(7)-(P(2,1)*xF(4)-P(1,1)*xF(3))/DTES       ESTO         DMC=xF(5)+xF(8)-(P(1,1)*xF(4)+P(2,1)*xF(3))/DTES       ESTO         SU=1.DU/UTES**3       ESTO         D(1,1)=4.D0*SD*(TF**2+TF*TI+TI**2)       ESTO         D(1,2)=-6.UD*SD*(TF*TI)       ESTO         D(2,2)=12.D0*SD       ESTO         D(2,2)=12.D0*SD       ESTO         D(2,2)=12.D0*SD       ESTO         RMD=0.D0       ESTO         RMD=0.D0       ESTO         D0 6 1=1,2       ESTO         D0 7 J=1,2       ESTO         RMD=RMD+D(1,J)*(P(2,J)*CI(1)-P(1,J)*SI(1))       ESTO         RMD=RMD+D(1,J)*(P(1,J)*CI(1)+P(2,J)*SI(1))       ESTO         CONTINUE       ESTO         UMER=PC(2)-PS(1)-RMU       ESTO         DENOM=PC(1)+PS(2)-RMO       ESTO         WKITE(6,27) UMER, DENOM       ESTO         WKITE(6,27) UMER, DENOM       ESTO         EX TO       ESTO         EX =0A TAN2(UMER, DE NOM)       ESTO         EX =0A TAN2(UMER, DE NOM)       ESTO	0290
PS(2)=XF(8)       ESTO         UMRC=XF(6)-XF(7)-(P(2,1)*XF(4)-P(1,1)*XF(3))/DTES       ESTO         DMC=XF(5)+XF(8)-(P(1,1)*XF(4)+P(2,1)*XF(3))/DTES       ESTO         SU=1.DU/UTES**3       ESTO         D(1,1)=4.D0*SD*(TF**2+TF*TI+TI**2)       ESTO         D(1,1)=4.D0*SD*(TF**1)       ESTO         D(1,1)=4.D0*SD*(TF*TI)       ESTO         D(1,1)=011,21       ESTO         D(2,2)=12.D0*SD       ESTO         IF(ENR.LT.DEGIGU TO 24       ESTO         RMD=0.D0       ESTO         00 6 1=1,2       ESTO         00 7 J=1,2       ESTO         RMU=RMU+D(1,J)*(P(2,J)*CI(I)-P(1,J)*SI(I))       ESTO         RMD=RMD+O(1,J)*(P(1,J)*CI(I)+P(2,J)*SI(I))       ESTO         CONTINUE       ESTO         UMER=PC(1)-PS(1)-RMU       ESTO         DENOM=PC(1)+PS(2)-RMD       ESTO         WHRTE(6,27) UMER, DENOM       ESTO         27       FURMATILM, 'NUMERATOR= ',D14.8,2X,*DENOM INATOR= ',D14.8)       ESTO         EXTO       ESTO         EXTO       ESTO         EXTO       ESTO         EXTO       ESTO         DOO 6 1=1,2       ESTO         CONTINUE       ESTO         CONTINUE       ESTO </td <td>0300</td>	0300
UMRC = XF (6) - XF (7) - (P(2, 1) * XF (4) - P(1, 1) * XF (3)) / DTES ESTO DMC = XF (5) + XF (8) - (P(1, 1) * XF (4) + P(2, 1) * XF (3)) / DTES ESTO S = 1. DU / DTES **3 ESTO D(1, 1) = 4. DU * SD*(TF **2 + TF *TI + TI **2) ESTO D(1, 2) = -6. UU * SD*(TF + TI) ESTO D(1, 2) = -6. UU * SD*(TF + TI) ESTO D(2, 2) = 12. UU * SD ESTO IF(ENR.LT. DEG ) GU TO 24 ESTO RMD = 0. DU ESTO RMD = 0. DU ESTO DU 6 1 = 1, 2 ESTO DU 6 1 = 1, 2 ESTO DU 7 J = 1, 2 ESTO RMU = RMU + D(1, J) * (P(2, J) * CI(I) - P(1, J) * SI(I)) ESTO RMD = RMD + D(1, J) * (P(2, J) * CI(I) + P(2, J) * SI(I)) ESTO 7 CONTINUE ESTO 0 CONTINUE ESTO 0 DENOM = PC(1) + PS(2) - RMD ESTO 0 WR IT E(6, 27) UMER, DENOM ESTO 27 FURMAT(IH , NUMERATOR = ', D14.8, 2X, 'DENUM INATOR = ', D14.8) ESTO	0310
DMC = XF (5) + XF (8) - (P(1,1) * XF (4) + P(2,1) * XF (3)) / DTES       EST 0         SU=1.D0/DTES **3       EST 0         D(1,1)=4.D0*SD*(TF **2*TF*TI+TI**2)       EST 0         D(1,2)=-6.D0*SD*(TF *TI)       EST 0         D(2,1)=D(1,2)       EST 0         D(2,2)=12.00*SD       EST 0         D(2,2)=12.00*SD       EST 0         IF(ENR.LT.DEGIGU TO 24       EST 0         RMD=0.D0       EST 0         RMJ=0.D0       EST 0         D0 6 I=1,2       EST 0         D0 7 J=1,2       EST 0         RMD=RMD+D(1,J)*(P(2,J)*CI(I)-P(1,J)*SI(I))       EST 0         RMD=RMD+D(1,J)*(P(1,J)*CI(I)+P(2,J)*SI(I))       EST 0         CON TINUE       EST 0         UMER=PC(2)-PS(1)-RMU       EST 0         DENOM=PC(1)+PS(2)-RMD       EST 0         WRITE(6,27) UMER, DENOM       EST 0         EX 0       EST 0         EX 0       EST 0         EX 0       EST 0         EX 0       EST 0         EST 0       EST 0         ES	0320
SD=1.D0/DTES**3       ESTO         D(1,1)=4.D0*SD*(TF**2+TF*TI+TI**2)       ESTO         D(1,2)=-6.00*SD*(TF+TI)       ESTO         D(2,1)=D(1,2)       ESTO         D(2,2)=12.00*SD       ESTO         IF(ENR.LT.DEG)GU TO 24       ESTO         RMD=0.00       ESTO         00 6 1=1,2       ESTO         00 7 J=1,2       ESTO         RMU=RMU+D(1,J)*(P(2,J)*CI(I)-P(1,J)*SI(1))       ESTO         RMD=RMD+D(1,J)*(P(2,J)*CI(I)+P(2,J)*SI(1))       ESTO         7       CONTINUE       ESTO         6       CONTINUE       ESTO         0ENOM=PC(1)+PS(2)-RMU       ESTO         0ENOM=PC(1)+PS(2)-RMU       ESTO         0ENOM=PC(1)+PS(2)-RMU       ESTO         27       FURMAT(IH , *NUMERATOR= *,014.8,2X,*DENOM INATOR= *,014.8)       ESTO         27       FURMAT(IH , *NUMERATOR= *,014.8,2X,*DENOM INATOR= *,014.8)       ESTO	0330
D(1,1)=4.D0*SD*(TF**2*TF*TI+TI**2)       ESTO         D(1,2)=-6.U0*SD*(TF+TI)       ESTO         D(2,1)=D(1,2)       ESTO         D(2,2)=12.D0*SD       ESTO         D(2,2)=12.D0*SD       ESTO         IF(ENR.LT.DEG)GU TO 24       ESTO         RMD=0.D0       ESTO         QU 6 I=1,2       ESTO         D0 7 J=1.2       ESTO         RMU=RMU+D(1,J)*(P(2,J)*CI(I)-P(1,J)*SI(I))       ESTO         RMD=RMD+D(1,J)*(P(1,J)*CI(I)+P(2,J)*SI(I))       ESTO         P       CONTINUE       ESTO         UMER=PC(2)-PS(1)-RMU       ESTO         DENOM=PC(1)+PS(2)-RMD       ESTO         WRITE(6,27) UMER, DENOM       ESTO         Z7       FURMAT(IH , 'NUMERATOR= ',D14.8,2X,'DENUM INATOR= ',D14.8)       ESTO         EX = DA TAN 2(UMER - DE NUM)       ESTO	0340
0(1,2)=-6.00*S0*(TF+TI)       EST0         0(2,1)=0(1,2)       EST0         0(2,2)=12.00*SD       EST0         1F(ENR.LT.0EG)GU TO 24       EST0         RMD=0.00       EST0         QU 6 1=1,2       EST0         D0 7 J=1,2       EST0         RMU=RMU+D(1,J)*(P(2,J)*CI(I)-P(1,J)*SI(I))       EST0         RMD=RM0+D(1,J)*(P(1,J)*CI(I)+P(2,J)*SI(I))       EST0         RMD=RM0+D(1,J)*(P(1,J)*CI(I)+P(2,J)*SI(I))       EST0         CONTINUE       EST0         b       CONTINUE       EST0         DENOM=PC(1)+PS(2)-RMU       EST0         DENOM=PC(1)+PS(2)-RMD       EST0         WRITE(6,27) UMER, DENOM       EST0         27       FURMAT(IH, 'NUMERATOR= ',D14.8,2X,'DENUM INATOR= ',D14.8)       EST0         EX =DATAN2(UMER, DENUM)       EST0       EST0	0350
D12,1)=D11,2)       ESTO         D12,2)=12.00*SD       ESTO         IF(ENR.LT.DEG)GU TO 24       ESTO         RMD=0.D0       ESTO         RMJ=0.D0       ESTO         D0 6 I=1,2       ESTO         D0 7 J=1,2       ESTO         RMU=RMU+D(I,J)*(P(2,J)*CI(I)-P(1,J)*SI(I))       ESTO         RMD=RM0+D(I,J)*(P(1,J)*CI(I)+P(2,J)*SI(I))       ESTO         RMD=RM0+D(I,J)*(P(1,J)*CI(I)+P(2,J)*SI(I))       ESTO         CONTINUE       ESTO         b       CONTINUE       ESTO         UMER=PC(2)-PS(1)-RMU       ESTO         DENOM=PC(1)+PS(2)-RMD       ESTO         WRITE(6,27) UMER, DENOM       ESTO         27       FURMAT(IH, 'NUMERATOR= ',D14.8,2X,'DENUM INATOR= ',D14.8)       ESTO         EXTO       ESTO         EXTO       ESTO         EXTO       ESTO	0360
D(2,2)=12.00*SD       ESTO         IF(ENR.LT.DEG)GO TO 24       ESTO         RMD=0.00       ESTO         RMJ=0.00       ESTO         D0 6 I=1,2       ESTO         D0 7 J=1,2       ESTO         RMU=RMU+D(I,J)*(P(2,J)*CI(I)-P(1,J)*SI(I))       ESTO         RMD=RM0+D(I,J)*(P(1,J)*CI(I)+P(2,J)*SI(I))       ESTO         7       CONTINUE       ESTO         6       CONTINUE       ESTO         0ENOM=PC(1)+PS(2)-RMD       ESTO         WRITE(6,27) UMER, DENOM       ESTO         27       FURMAT(IH, 'NUMERATOR= ',D14.8,2X,'DENOMINATOR= ',D14.8)       ESTO         EXTO       ESTO	0370
IF(ENR.LT.DEG)GO TO 24       ESTO         RMD=0.DO       ESTO         RMJ=0.DO       ESTO         DO 6 I=1,2       ESTO         DO 7 J=1,2       ESTO         RMU=RMU+D(I,J)*(P(2,J)*CI(I)-P(1,J)*SI(I))       ESTO         RMD=RMO+D(I,J)*(P(1,J)*CI(I)+P(2,J)*SI(I))       ESTO         RMD=RMO+D(I,J)*(P(1,J)*CI(I)+P(2,J)*SI(I))       ESTO         CONTINUE       ESTO         UMER=PC(2)-PS(1)-RMU       ESTO         DENOM=PC(1)+PS(2)-RMD       ESTO         WRITE(6,27) UMER, DENOM       ESTO         Z7       FURMAT(IH, 'NUMERATOR= ',D14.8,2X,'DENOMINATOR= ',D14.8)       ESTO         EXTO       ESTO	0380
RMD=0.00       ESTO         RMJ=0.D0       ESTO         D0 6 1=1,2       ESTO         D0 7 J=1,2       ESTO         RMU=RMU+D(1,J)*(P(2,J)*CI(1)-P(1,J)*SI(1))       ESTO         RMD=RM0+D(1,J)*(P(1,J)*CI(1)+P(2,J)*SI(1))       ESTO         7 CONTINUE       ESTO         6 CONTINUE       ESTO         0DR0M=PC(2)-PS(1)-RMU       ESTO         0ENOM=PC(1)+PS(2)-RMD       ESTO         WRITE(6,27) UMER, DENOM       ESTO         27 FURMAT(1H , 'NUMERATOR= ',D14.8,2X,'DENOMINATOR= ',D14.8)       ESTO         EXTO       ESTO	0390
RMJ=0.D0       ESTO         D0 6 I=1,2       ESTO         D0 7 J=1,2       ESTO         RMU=RMU+D(I,J)*(P(2,J)*CI(I)-P(1,J)*SI(I))       ESTO         RMD=RMD+D(I,J)*(P(1,J)*CI(I)+P(2,J)*SI(I))       ESTO         RMD=RMD+D(I,J)*(P(1,J)*CI(I)+P(2,J)*SI(I))       ESTO         CONTINUE       ESTO         CONTINUE       ESTO         UMER=PC(2)-PS(1)-RMU       ESTO         DENOM=PC(1)+PS(2)-RMD       ESTO         WRITE(6,27) UMER, DENOM       ESTO         27       FURMAT(IH, 'NUMERATOR= ',D14.8,2X,'DENUM INATOR= ',D14.8)       ESTO         EX =DATAN2(UMER, DENUM)       ESTO	0400
D0 6 I=1,2       ESTO         D0 7 J=1,2       ESTO         RMU=RMU+D(I,J)*(P(2,J)*CI(I)-P(1,J)*SI(I))       ESTO         RMD=RMD+D(I,J)*(P(1,J)*CI(I)+P(2,J)*SI(I))       ESTO         7 CONTINUE       ESTO         6 CONTINUE       ESTO         0 DENOM=PC(1)-PS(1)-RMU       ESTO         0 DENOM=PC(1)+PS(2)-RMD       ESTO         0 RRITE(6,27) UNER, DENOM       ESTO         27 FURMAT(IH, 'NUMERATOR= ',D14.8,2X,'DENUM INATOR= ',D14.8)       ESTO         EX =DATAN2(UMER, DENUM)       ESTO	0410
D0 7 J=1,2       ESTO         RMU=RMU+D(1,J)*(P(2,J)*CI(I)-P(1,J)*SI(I))       ESTO         RMD=RMD+D(1,J)*(P(1,J)*CI(I)+P(2,J)*SI(I))       ESTO         7 CONTINUE       ESTO         6 CONTINUE       ESTO         0 DENOM=PC(1)-PS(1)-RMU       ESTO         0 DENOM=PC(1)+PS(2)-RMD       ESTO         0 RRITE(6,27) UNER, DENOM       ESTO         27 FURMAT(IH, "NUMERATOR= ",D14.8,2X,"DENOM INATOR= ",D14.8)       ESTO         EX =DATAN2(UMER, DENOM)       ESTO	0420
RMU=RMU+D(1,J)*(P(2,J)*CI(I)-P(1,J)*SI(I))       ESTO         RMD=RMD+D(1,J)*(P(1,J)*CI(I)+P(2,J)*SI(I))       ESTO         7       CONTINUE       ESTO         6       CONTINUE       ESTO         0       MMER=PC(2)-PS(1)-RMU       ESTO         0       DENOM=PC(1)+PS(2)-RMD       ESTO         0       RITE(6,27)       UMER, DENOM         27       FURMAT(IH, 'NUMERATOR= ',D14.8,2X,'DENUM INATOR= ',D14.8)       ESTO         EX       #DATAN2(UMER, DENUM)       ESTO	0430
RMD=RMD+D(1,J)*(P(1,J)*CI(1)+P(2,J)*SI(1))       ESTO         7       CONTINUE       ESTO         6       CONTINUE       ESTO         0       MER=PC(2)-PS(1)-RMU       ESTO         0       DENOM=PC(1)+PS(2)-RMD       ESTO         0       NUMER, DENOM       ESTO         27       FURMAT(1H, *NUMERATOR= *, D14.8, 2X, *DENUM INATOR= *, D14.8)       ESTO         EX =DATAN2(UMER, DENUM)       ESTO       ESTO	0440
7       CONTINUE       ESTO         6       CONTINUE       ESTO         0       UMER=PC(2)-PS(1)-RMU       ESTO         0       DENOM=PC(1)+PS(2)-RMD       ESTO         0       NRITE(6,27)       UMER, DENOM         27       FURMAT(1H, "NUMERATOR= ", D14.8, 2X, "DENOM INATOR= ", D14.8)       ESTO         EX =DATAN2(UMER, DENOM)       ESTO	0450
6       CONTINUE       ESTO         UMER=PC(2)-PS(1)-RMU       ESTO         DENOM=PC(1)+PS(2)-RMD       ESTO         WRITE(6,27)       UMER, DENOM         27       FURMAT(1H, "NUMERATOR= ", D14.8, 2X, "DENOM INATOR= ", D14.8)         EX       ESTO         EX       ENOM         EX       ENOM         EX       ENOM	0460
UMER=PC(2)-PS(1)-RMU         ESTO           DENOM=PC(1)+PS(2)-RMD         ESTO           WRITE(6,27)         UMER, DENOM         ESTO           27         FURMAT(1H, "NUMERATOR= ",D14.8,2X,"DENOM INATOR= ",D14.8)         ESTO           EX =DATAN2(UMER, DENOM)         ESTO         ESTO	0470
DENOM=PC(1)+PS(2)-RMD WRITE(6,27) UMER, DENOM 27 FURMAT(LH ,'NUMERATOR= ',D14.8,2X,'DENOM INATOR= ',D14.8) EX =DATAN2(UMER.DENUM) EX =DATAN2(UMER.DENUM) EX =DATAN2(UMER.DENUM)	0480
wRITE(6,27)         UNER, DENOM         ESTU           27         FURMAT(LH, 'NUMERATOR= ', D14.8, 2x, 'DENOM INATOR= ', D14.8)         ESTU           Ex         = DA TAN2(UMER, DE NUM)         ESTU	0490
27 FURMAT(LH , 'NUMERATOR= ', 014 .8, 2X, 'DENUM INATOR= ', 014 .8) ESTO EX =DATAN2(UMER .DE NUM) ESTO	0500
EX =DA TAN 2 ( UMER . DE NUM) ESTO	0510
	0520
WRITE(6,27)UMRC, DAC ESTO	0530
TEXC(1)=DATAN2(UMRC, DMC) ESTO	0540
C ESTO	0550

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FILE: CESTM FORTRAN PL
                                           THE BROWN BICENTENNIAL COMPUTER CENTER
C INITIALIZE EST . COEFF
                                                                      E ST00560
C
                                                                      EST00570
24
     DO 2 1=1,2
                                                                      EST00580
     EA(1)=0.DU
                                                                      E ST00590
2
     EB(1)=0.DO
                                                                      EST00600
C
                                                                      EST00610
 COMPUTE ESTIMATED VECTORS 'EA' & 'EB'
                                                                      EST00620
C
                                                                      EST00630
C
     DU 3 1=1,2
                                                                      EST00640
     DO 4 J=1,2
                                                                      EST00650
     EA(I)=EA(I)+D(I,J)*(P(1,J)-V*(DCUS(Ex)*CI(J)-DSIN(Ex)*SI(J)))
                                                                      EST00660
     EB(1)=EB(1)+D(1, J)*(P(2, J)-V*(DSIN(EX)*C1(J)+DCDS(EX)*S1(J)))
                                                                      EST00670
     CONTINUE
                                                                      EST00680
4
3
     CONT INUE
                                                                      EST00690
C
                                                                      EST00700
C
 COMPUTE CONSTANT EST. VECTOR
                                                                      EST00710
C
                                                                      EST00720
     TExc(2)=(xF(1)-xI(1)-V*(xF(4)*DUOS(TExc(1))-xF(3)*DSIN(TExc(1)))/EST00730
     CDTES
                                                                      EST00740
     TEXC(3)=(XF(2)-XI(2)-V*(XF(4)*US IN(TEXC(1))-XF(3)*DSIN(TEXC(1)))/EST00750
    CDTES
                                                                      EST00760
C
                                                                      EST00770
 STURE LINEAR EST. VECT CR FUR ERRCR COMPUTATION.
C
                                                                      E ST00780
C
                                                                      EST00790
     TEX (1)= EX
                                                                      EST00800
     TEX(2)=EA(1)
                                                                      EST00810
     TEX(3)=EA(2)
                                                                      EST00820
     TEX(4) = EB(1)
                                                                      EST00830
      TEX(5) =EB(2)
                                                                      EST00840
     DUM= 0.00
                                                                      EST00850
С
                                                                      ESTU0860
C COMPUTE THE ESTIMATION ERROR
                                                                      EST00870
                                                           ESTOO880
C
                                                                  E ST00890
     NDIM2=4
     PRMT2(1) =TI
                                                                      EST00900
     PRMT2(2)=TF
                                                                      EST00910
     PRMT2(3)=DTIN
                                                                      EST00920
     PRMT2(4)=ERBD
                                                                      EST00930
                                           EST00940
     00 9 1=1,4
     DERY2(1)=1.D0/4.D0
9
                                                                      EST00950
     DO 10 1=1,2
                                                                      EST00960
10
     Y2(1)=wIN(1)
                                                                      EST00970
     Y2(3)=0.00
                                                                      EST00980
                           ANTHER CONTRACT PROVIDENCES ANTHER ANTHER ANTHER
     Y2141=0.00
                                                                      EST00990
                                                 ESTO1000
     IPRI=0
     CALL DRKGS(PRMT2, Y2, DERY2, NDIM2, 1HLF2, FCT2, DUT P2, AUX2) ESTOIOIU
                                                                   380-0
     WRITE(6,15)IHLF2
                                                                      EST01020
15
     FORMAT(1H , 'IHLF2=',12)
                                                                      EST01030
      IF(Y2(3).LE. 1.D-10) IPRI=1
                                                                      EST01040
     WRITEL8.5JNC
                                                                      EST 01 050
      WRI TE(6,5)NC
                                                                      E ST01060
     FORMAT(1HO, "AFTER THE", 14," TH ESTIMATICN, THE ESTIMATED STATE ANDESTO1070
5
    C ERRCR ARE'//1H ,5X, *X(3)*,14X, *A(1)*,14X, *A(2)*,14X, *B(1)*,14X, *BESTOL080
    C(2)',14X,'ERROR')
                                                                      EST01090
     WRITE(6,8)EX, EA(1), EA(2), EB(1), EB(2), Y2(3)
                                                                      EST01100
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FILE:	CESTM	FORTRAN	PL		THE BROWN	BICENTENNIAL	COMPUTER CENTI
	WRITEIS	.8 JEX . EAG	1), EA(2).	EB(1). EB(2	2), 72(3)		ESTOLLIO
8	FORMATE	1H .6(D14	.8.4X))				EST01120
Sec. No. 1	WRITE(8	BITEXC (1	), TEXC(2)	. DUM. TEXC	3).DUM. Y2(4)		EST 01130
Crowner							EST01140
C UPDA	TE INIT	IAL CONDI	TION				EST 01150
c							ESTOL160
	DO 16 1	=1.2			Sec. Street and a		ESTOL170
16	X1(1)=X				194.4 C 199 - 194 7 1		EST01180
	X1(3)=T	HE					ESTOIL 90
	DO 28 1	=1.2					EST01200
R	WIN(I)=	72(1)+RAM	P				ESTOLZIO
	EX=EX+T	HE -THI					E ST01220
	TEXC(1)	TE XC (1)+	THE-THI			The second second second	EST01230
	RETURN						EST01240
	END						E ST01250
	SUAROUT	NE ECTOL	T. YZ.DERY	21			ESTOLZAO
	INDI 1CT	DEAL	A-H-0-71			Partial States of the	ESTOLUZO
	DIMENSI	NERL	HIN121.06		3.31.TY/61.T	ALST TYCIST	EST01270
	COMMON		TI TE Nº	TH TH TOUL	212111113111	01211111131	E 5101280
	COMMON		HI THE EN	TUATUAT AK			ES101290
	COMMON/		HI I HE IEN		VILEUN LAISAIN		ESTOT 300
00100	COMMON/		O'DM'MIN'	000,000,11			ESTOISIO
43.5446	LUMMUN/	-2/12					EST01320
	IFICIBL	2J.LI.180	1)). ANU. (	1.62.18(1)	1160 TU 3	5 MD 103 4 1 12 3	EST01330
082.00	IFCT.LT.	. 18(1))60	10 2				EST01340
	IFIT.LT	-TB(2))GU	10 3				EST01350
	UIN=ITB	(1) - 11 + 1 -	18(2))=01				E ST01360
	GO TO 1						EST01370
<b>L</b> 0 8 8 400	UIN=(T-	ri)#U1					EST01380
20333	GO TO 1						EST01390
3, 2000	UIN= (TB	11)-71)+0	1				EST01400
Landon	THETA=T	HI+UIN					EST01410
01000	ANGL=TX	(1)+UIN					EST01420
	ANGC=TX	C(1)+UIN					ESTO1430
	DYL =A+D	COSITHETA	)+Y2(1)				EST01440
144200	UY2=A+D	SIN ( THE TA	J+Y2(2)				EST01450
64400	DERY2(1	= DW(1,1)	*Y2(1)+DW	(1,2)* 72(2	:)		ESTUL460
625 10	DERY2(2)	= DW(2,1)	*Y2(1)+Dw	(2,2)=¥2(2	1		EST01470
62833	DERY213	)= ( DY1-A*	DCOSTANGL	)-TX(2)-TX	((3) *T) ** 2+(D	¥2	EST01480
Gertad	C-A+DSIN	(ANGL)-TX	(4)-TX(5)	*11**2			EST01490
	DERY2(4	)=(DY1-A=	DCOSLANGC	1-TXC(2))*	#2+(UY2-A*DS	IN(ANGC)-TXCI	3) EST01500
0.000	CJ##2						EST01510
GT.P.CH	RETURN						EST01520
	END				Section of the		EST01530
	SUBROUT	INE OUTP2	(X, Y2, DER	Y2. IHLF2.N	DIM2, PRMT21		EST 01 540
60010	IMPLICIT	REAL+81	A-H, 0-Z)				EST01550
61010	DIMENSI	DN Y2(1),	DERY2(1),	PRMT2(1)	AL SALVE LAND	W. KW. LTROCKS	EST01560
DERICE	RETURN					TARA A	EST01570
DEDIS	END				Self States The	Charles Charles	EST01580
	103					and the second and	101100100
546 1A	TZB				A CARLES AND	A STATE STATE A STATE	Contribution and the
1201150 00	123						A LAND PROVIDENCE
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35016	200,33	1. 1.1.1.2.28.	The first the state		A REAL PROPERTY OF THE REAL PR	A THE REAL PROPERTY AND A	
Stole Garta	3.8 * 1 × 4	d., * + ( 13)*.	201.111.1241	1. 4 X P & P & P & P & P & P & P & P & P & P	· · · · · · · · · · · · · · · · · · ·	11// 11 + 2/2 + 2/	43 HOMES F
01010 00010 00010	Beryxa Tes	4, 14 281.	20141 (21)	18 11 4. 15	Sale of the set of		12 82463 3 X81716363

## THE BROWN BICENTENNIAL COMPUTER CENTER

PRE00010 SUBROUTINE PRED(X, EX, EA, EB, T, TIR, T2R, UR) THE PURPOSE IS TO COMPUTE A BANG-BANG CONTROL WHICH DRIVES THE PRE 00020 C MODEL SYSTEM TO THE TARGET VIA A GEOMETRICAL APPROACH. PRE 000 30 C INPUT: STATE VECTOR "X", EST. HEADING "EX", COEFF. "EA" & "EB", INITIAL PREDOUGO C PRE00050 CC TIME. OUTPUT: SWITCH TIMES, CONTRUL PRE00060 C PRE00070 PRE00080 С IMPLICIT REAL+8(A-H,O-Z) PREDDOGD PRE00100 DIMENSIUN X(1), EA(1), EB(1), ZIN(2), THD(2), CWD(2,2), WND(2), TXC(3) PREDOLLO COMMON DS, DI, ERBD, TI, TF, NP, IN, IM, IPRI PRE00120 COMMON/PR/WIND, IMP COMMEN/F1/V,UDL,TBD,CWD,WND,UPD,DGL,TXC,PI,CV PRE 00130 PRE00140 COMMON/EX/TFIN, RK, ISK COMMON/LAST/VT,OLJ PRE00150 PRE00160 C PRE00170 COURDINATE TRANSFORMATION C PRE00180 TEND=1.DO/DFLOAT(IN-NP) PRE00190 PRE00200 SCAL=TFIN-T PRE00210 WRITE(8,14)EA(1),EA(2),E8(1),E8(2) FORMAT(1H ,4(014.8,2X)) PRE00220 14 PREJUZ30 VT=V\*SCAL ZIN(1)=X(1)/VT+(EA(1)+EA(2)\*(TFIN+T)/2.DO)/V ZIN(2)=X(2)/VT+(EB(1)+EB(2)\*(TFIN+T)/2.DO)/V PRE 00240 PRE00250 WIND=DATAN2((EB(1)+EB(2)+TFIN),(EA(1)+EA(2)+TFIN))-PI PRE00260 RH0=DSQRT(ZIN(1)\*+2+ZIN(2)\*+2) PRE00270 PREDU280 PHI=DATAN212IN(2),ZIN(1)) PRE00290 WRITE(8,9)RHO, PHI, WIND FORMAT(1H ,8X, 'RHO',12X, 'PHI',12X, 'WIND ANGLE'/1H ,2X,4(D14.8,2X))PRE00300 PRED0310 T15=0.00 PRE 00320 T2S=0.DU PKE00330 IMP=0 PS1=0.00 PRE00340 PRE 00350 PS2=0.00 PRE00360 PSU=0.DO PRE00370 POLJ=1.010 PEFF=0.D0 DEFF=0.D0 DEFF=0.D0 PRE00380 PRE00390 IF(RHO.GE.1.DO)IMP=1 PRE 00400 PRE00410 PRE00420 C C COMPUTE BANG-BANG CONTROL ACCORDING TO LINEAR WIND MODEL PRE00430 C.0.10 PRE00440 CALL MGEU(RHO, PHI, EX, TIS, T2S, U) IF(IMP.NE.1)GO TO 6 PRE00450 PRE00460 DET=VT+DSQRT(OLJ) PRE00470 IMP=0 PRE 004 80 IF(TEND.GE.T2S)DEFF=DABS((TEND-T2S)\*U) PRE00490 CPS1=T1S PREDOSOO CPS2=T2S PRE00510 CPU=U PRE00520 IF(IPRI.EQ.1)GD TO 11 PRE00530 PRE 00540 IF(ISK.EQ.1)GO TO 12 PRE00550

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FILE: PRED

FORTRAN P1

	C A THE REAL PROPERTY AND A REAL PROPERTY A REAL PROPERTY A REAL PROPERTY AND A REAL PROPERTY A REAL PROPERTY AND A REAL PROPERTY A REAL PROPERTY A REAL PROPERTY A REAL PROPERTY A REAL P	1999 - 223 - 3
:	INPUTE BANG-BANG CONTROL ACCORDING TO CONSTANT WIND NODEL	PRE00560
		PRE00570
	7 IN(1)=(X(1)+TX(12)=SCAL)/VT	PRE00580
	7 IN(2)= (¥ (2) ATYC(3) ASCAL 1/VT	PRE00590
		PREDOGOO
		PRE00610
		PRE00010
		PRE 000 20
	WRITE(8,9)RHU,PHI,WIND	PREDUGSU
	IF (RHO.GE.1.DO) IMP=1	PREUU640
	SP=TXC(1)	PRE 00650
	CALL MGEO(RHO,PHI,SP,T1S,T2S,U)	PRE00660
	IF(IMP.NE.1)GO TO 6	PRE00670
	IMP=0	PRE00680
	POLJ=VT+DSQRT(OLJ)	PREUD690
	PS1=T1S	PRE00700
	PS2=T2S	PRE00710
	PSU=U	PRE00720
		PRE00730
CO	IMPUTE BANG-BANG CONTROL ACCORDING TO LINEAR PLUS CONSTANT WIND MODEL	PRE00740
		PRE00750
2	DSCA=SCAI #PK	PRE 00760
		PRE00770
		PREDOTIO
	REM-SCAL-USCA	PRE00700
	ZINIT = (AIT + CAIT + CAIT + COSCA+2.DO+172.DO+ USCA+CAIT + CAIT	PREDUTIO
	CR SCAJ TRE MJ / VI	PREUDBUU
	ZIN(2)= (X(2)+(EB(1)+EB(2)=(USCA+2.00=)/2.00)=DSCA+(EB(1)+EB(2)=	PREDUBIU
	CRSCAJ*REMJ/VT	PRE00820
	WIND=DATAN2(EB(1)+EB(2)*RSCA,EA(1)+EA(2)*RSCA)-PI	PRE00830
	RHU=DS GRT (ZIN(1)++2+ZIN(2)++2)	PRE 00840
	PHI=DATAN2(ZIN(2), ZIN(1))	PRE00850
	WRITE(8,9)RHO,PHI,WIND	PRE00860
	IF ( RHO . GE . 1 . DO ) 1 MP = 1	PRE 00870
	CALL MGEO(RHO,PHI,EX,T1S,T2S,U)	PRE00880
	IF(IMP.NE.1)GO TO 6	PRE00890
	OLJ=VT+DSQRT(OLJ)	PRE 00900
	IF(TIS.GT.O.DO)OEFF=DABS(DMIN1(TIS.TEND)*U)	PRE00910
	IF(TEND.GT.T2S)UEFF=DABS((TEND-T2S)=U)	PRE00920
	WRITE(A.B)	PRE00930
	FORMAT (1H .8x. "T1".15x."T2".8x."CUNTRUL".8x."EXP MISS DISTANCE")	PRE00940
	WRITE(8.7)CPS1.CPS2.CPU.DET.PS1.PS2.PSU.POLJ.TIS.T2S.U.OLJ	PRE00950
0.69	EORMAT(1H -2X-6(D14-8-2X)/1H -2X-6(D14-8-2X)/1H -2X-6(D14-8-2X))	PR F00960
1.5		PRE00970
240		PREDORA
利用的		PRECOUPOO
1790	TELEVISION AND AND AND A TELEVISION AND A A	PRE00990
1. 184	IF ( UEFF. JE . DEFF ). AND. (DEFF. JE . PEFF / JGO TO 4	PREDIOUD
法正常	IF((PEFF.GE.UEFF).AND.(PEFF.GE.DEFF))GU TU IU	PREDIDIO
100	115-0751	PREULUZO
	123=6732	PREULUSU
R. Solo	UPCPU (Det 25 T-04 FT11, and Britting Britting	PRE01040
	GO TO 4	PRE01050
0	TI S=PSI	PRE 01060
e al	12S=PS2	PRE01070
S an p	U=P SU	PRE01080
	GO TO 4	PRE01090
2011		

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THE BRIDER BIGGREET LEADERS GEALER HADRE
                                                                       THE BROWN BICENTENNIAL COMPUTER CENTER
    FILE: PRED
                                      FORTRAN PI
    C COMPUTE SWITCH TIMES, CONTROL IN INERTIAL COORDINATE PREDIIO
    C
                                                   PREOIL20
    6
                  T 1R=T1 S*SCAL+T PRE01130
                 12R=T2S*SCAL+T PREDL140
                 UR=U/SCAL
                                                                                                                                          PRE 01150
                                                                                                                                                          PRE01160
                  WRITE(8,2)
                                                                                                              15-010-11 8 # J.J.H.
                 WRITE(6,2)
                                                                                                                                                                    PRE01170
                FORMAT(1H0, THE SWITCH TIMES AND CONTROL ARE "// 1H , 5X, "T1", 15X, "TPRE01180
    2
                                                                                                                                    PREJ1190
               C2'.15X. 'U'/1
                 WRITE(8,1)TIR, T2R, UR
                                                                                                                                                                    PRE 01 2 00
                 WRITE(6,1)TIR, T2R, UR
                                                                                                                                                                    PRE01210
                                                                                                                                                   PRE0 1220
    1
                 FORMAT(1H , 3(014.8,2X))
                 GO TO 3
                                                                                                                                                                    PRE 01230
                 WRITE(6,5)
                                                                                                                                                                    PRE01240
                  FORMAT(1HO, "THE FIRST GEOMETRICAL APPROACH FAILS") PRE01250
    5
                 GU TO 6
                                                                                                                                                                    PRE01260
           3 RETURN
                                                                                                                                                   PRE01270
                                                                                                                                                   PRE 01280
                  END
                                              X HI GO LOC. O. M. CTHER DOCK HERE AN ON DECKING CO. 1141
     自我们的学校和爱
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FILE	: MGEO	FORTRAN	Pl	THE	BROWN	BICENTENNIAL COMP	UTER CENTE
	SUBROU	TINE MGEOLA	HO,PHI,THET	A.TIS.TZS.UST	AR J		MGE00010
C	THIS R	OUTINE COMP	UTES A BANG	-OFF-BANG CON	TROL V	IA A GEOMETRICAL	MGE 00020
C	APPRCA	CH. THIS IS	POSSIBLE O	NLY WHEN THE	PARACH	UTE IS WITHIN THE	MGE00030
č	UNITO	IRCLE. FOR	THE CASE WH	EN IT FALLS O	UTSIDE	THE UNIT CIRCLE.	MGE00040
C. F.L	A SECO	ND APPROACH	IS USED TO	COMPUTE A BA	NG-OFF	. OFF-BANG. BANG.	MGE00050
C	OR OFF	CONTROL DE	PENDING UN	WHICH HOULD R	ESULT	A MINIMAL EXPECTED	MGE00060
2011	MISS D	ISTANCE.	r chorno on				MGE00070
- Washi	THOIT	IT DEAL + A	(				MGEODORO
	OTMENS	10N 0/21 5/	21.6121.512	1. TETAD (2) TC		-201. 11/2. 201. 12/2	MC E00000
	C 201 III	21 IM( 21 OT	CTI 21	11131AK (21113	MULLE	120111112120111212	MCEOOLOO
	C201101		51121				MCCOOLIO
	COMMON	CASI/VIIUL	5				MCEODITO
	CUMMUN	/PR/SOCIATI					MGEUUIZU
	TWUPIE	2.DUTUARCUS	(-1.00)				MGEUOI 30
	WRITE	8,31					MGEUUL40
	N1=5						MGE00150
C			S. Carlassan O	ومردوب ومرور مرور	Gue	TANKS DUCT TO STATE	MGE00160
C IN	ITIAL IZE	BEST CONTR	OL, ENERGY, B	ANG-OFF TIMES	•		MGE00170
C							MGE00180
	UST AR=	•0 • D0					MGE001 90
	BETA=S	BETA					MGE00200
	ESTAR=	1.010					MGE00210
	T15=0.	DO					MGE00220
	T25=0.	00	the second second				MGE00230
	ID=0						MGE00240
	IF( IMP	.EQ.1)GC TO	119				NGE 00250
	DO 19	NN=1.N1					MGE00260
	N=NN-C	1+11/2					MGE00270
	ENDEL	DAT (N)					NGE 00 280
	PCINT	HODI NE NA THE	TAARETA				MGE00290
	JEIPEI	N. 60.0.001	CO TO 19				MGE00300
	LEIDE	NA THE TAL-DC	INSPHORACCE		1 CO T	0.7	HGE00310
	TELLO	AL THE LAT-PS	INTRACTOCUS	TPHI / INCOUTING	001	CO TO 7	HGEOUSIO
	1711.0	U-ULUSI INEI	AT-FSIN+KNU	TUSINIPHII . NE		60 10 7	MGEOUJZU
	IFLIAD	SINJ.GE.21	CO IO IA				MGE 00330
	R(1)=1	.OO/PSIN					MGE00340
	U(1)=P	SIN					MGE00350
0.12.57	E(1)=P	SIN##2					MGE 00360
C							MGE00370
C UP	DATE BES	T CONTROL, E	NERGY.				MGE00380
C							MGE00390
	IFLEST	AR.LT.E(1))	GO TO 19				MGE00400
	IF LEST	AR. EQ. E(1))	GO TU 103				MGE00410
	ESTAR-	E(1)					MGE00420
	USTAR-	U(1)					MGE00430
	10=1						MGE00440
	GO TO	99		and the second second			NGE00450
103	IFIDAS	S(U(1)).GE.	DABS(USTAR)	160 TO 19			MGE00460
100	USTAR						MGE00470
	ID=1						MCEOO4 BO
00	HOITE	8.981		States to the last			MGEOOADO
98	EOPMAT	41H .+ TI -T2	1.//1H		. 174. 0	P(1)	000500500
	14.151	141	177 TH 1341				MCEOOSIO
	LAT'ELL						H0E00510
-	MALTE(	0,231 N, PS1	MARELIAUELI	12111			HGEUUS20
23	FURMAT	11H ,5X,12,	22,41014.8,	3711			HGE00530
	GO TO	14					MGE00540
C							MGE 00550

FILE:	MGEO FORTRAN P1 THE BROWN BICENTENNIAL	COMPUTER CENTER
<b>C</b>	COMPUTE THE TURN RADIUS	MGE 00560
C		MGE00570
7	A=PS IN++2-2.D0+(1.D0-DC0S(THETA-BETA))	MGE00580
	B=PSIN+RHU+(DSIN(PHI-THETA)-DSIN(PHI-BETA))	MGE00590
	C=1.DO-RH0 ++2	MGE 006 00
	D=d++2-A+C	MGE 0061 0
	LF(D-LT-0-D0) GO TO 19	MGE00620
	$\beta(1) = (H + DSORT(D))/A$	MGE00630
	R(2) = (R - OSCRT(D))/A	MGEOOGSO
		MCEODOFU
		MCEOOCSO
	G0 10 a	HGEODOGOU
15		MGE UUG TU
13	31-0	MGEUU680
		MGEOUD 90
		MGE 00700
	1	MGEUUTIO
100000		MGE00720
	IF(R(2)+PSIN.LE.U.DU) GU TU 6	MGE00730
	IF(R(2)=PSIN.GE. 1. DO) GU TO 6	MGE00740
01619	J2=1	MGE00750
6		MGE00760
	IF(J.EQ.0) GO TO 19	MGE00770
	IF(J.EQ.2) GO TO 8	MGE 00780
	IF(J1.EQ.1) GO TO 8	MGE00790
	R(1)=R(2)	MGEOUBOO
Citat	147. 00015. 801. V.T. 011	MGE 008 10
C	COMPUTE THE CONTROL, ENERGY, AND TURN ANGLE	MGE00820
C		NGE00 830
00.4 C 8	DO 9 I=1,J	MGE 00840
	U(I)=1.DO/R(I)	MGE00850
	E(I)=PSIN/R(I)	MGE 00860
	F(1)=(R(1)+(DSIN(THETA)-DSIN(BETA))-RHO+DCOS(PHI))/(1.DO-R(1)	*P \$ INAGE00870
Date and Pa		MGEODAAO
	G(1)=(R(1)+(DCOS (BETA)-DCUS (THETA))-RHOEDSIN(PHI))/(1,DO-R(1))	*PSINNGE 00890
neutri		MGE00900
103 345	VF(F(1), E9 1, D0) G0 T0 10	MGE00910
	ISTAR(I)=DSIGN(1,D0,G(I))=DARCOS(F(I))	MGE 009 20
	60 TO 11	MGE 009 30
10	TSTAR(I)=DARCOS(F(I))	MGEOOGAO
II		MGE 00950
6	highundha situ utuus	MGEOOPAO
-	COMPLIE THE SHITCH TIMES	MCE00900
		HGEOUSTU
	00 12 VV-1 V1	NGE OUYBO
66639		MGEOUYYO
- 12 G C 434	1-1 ( 11/ 10,10,10	MCEULOUO
10		MGEOIOIO
		MGE01020
18		MGE 01 030
20	ISTARKEL (K)=ISTARLIJ+INUPI=FLOAT(K)	MGE01040
	IL (I)KJ=K(IJ=(ISTARK(I)KJ-THETA)	MGE01050
一部をあるな	12(1+K)=1.DO-R(1)+(TWOPI+FN-TSTARK(1+K)+BETA)	MGE 01060
63,63.6	IF(T1(1,K).LT.0.DO) GO TO 12	MGE01070
「公式の多な」	IF (T2(1,K).GT.1.00) GO TO 12	MGE OL 080
142617	WRI TE(8,4) N,PSIN,R(I),T1(1,K),T2(1,K),TSTARK(1,K),U(1),E(1)	NGE01090
C		MGEO1100

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FORTRAN PL THE BROWN BICENTENNIAL COMPUTER CENTER FILE: MGEC C UPDATE BEST CONTROL, ENERGY, TIMES. MGE01110 MGE01120 C IF(ESTAR.LT.E(I))GO TO 12 MGE01130 IF (EST AR. LQ. E( 1) ) GO TO 100 MGE01140 ESTAR=E(1) MGE01150 USTAR=U(I) MGE01160 T15=T1(1,K) MGE 01170 12 S= 12 (1 ,K) MGE01180 MGE 011 90 ID=2 GO TC 12 MGE01200 100 IF(DABS(U(I)).GE.DABS(USTAR))GO TO 12 MGE01210 MGE01220 USTAR=U(1) T15=T1(1,K) MGE 01230 T25=T2(1,K) MGE01240 10=2 MGE01250 12 CONTINUE 33 10 100.0.112010PH1 10 MGE 01260 E OT DO (COLLAD, MARTIN) CONTINUE 9 MGE01270 19 CONTINUE MGE01280 IF( 10.EQ.0)GO TO 108 MGE01290 MGE01300 IF( 10 .NE . 1)GO TO 101 C MGE01310 PRINT OUT THE BEST CONTROL, ENERGY, TIMES. C MGE01320 C MGE01330 WRITE(8,106) MGE 01 340 106 FORMAT(1H0,20X, 'BEST CONTROL', 3X, 'MIN ENERGY', /) MGE01350 WRITE(8,105)USTAR,ESTAR MGE01360 FORMAT (1H ,5x, 'T1=T2', 10x, 2(D14.8)) 105 MGE 01 370 GO TO 102 MGE01380 101 WAITE(8,107) MGE01390 FORMAT(1H0,8x, 'T1',15x, 'T2',8X, 'BEST CONTROL', 5X, 'MIN ENERGY') 107 MGE01400 WRITE(8, 104) TLS, T2S, USTAR, ESTAR MGE01410 104 FURMAT(1H ,2X,4(D14.8,2X)) MGE01420 GO TO 102 MGE01430 108 IMP=1 MGE01440 F33-520,1343(2094912120+098+1143944+2050-14436120302+11372+1 MGE 01450 C THE FIRST GEOMETRICAL APPROACH FAILS IF ID=0. MGE01460 C MGE01470 NGE 01480 WRITE(8,109) FORMAT(1HO, "NO FEASIBLE BANG-OFF-BANG CONTROL EXISTS.") 109 MGE01490 MGE01 500 £ START THE SECOND GEOMETRICA APPROACH MGE 01510 C MGE 01 520 C 119 X1=RHO=OCUS(PHI) MGE01530 X2=RHO+DSIN(PHI) MGE01540 OLJ=1.020 MGE01550 MGE 01 560 05W1=0.00 05H2=0.00 MGE01570 MGE01580 DO 115 N=1,5 BETA=SBETA+TWOPI +DFLOAT (N-3) NGE 01 590 IFITHETA.EQ.BETAIGO TO 115 【史】 第四位 王帝帝王帝的法王帝王帝王帝王帝王帝王帝王帝王帝帝帝王帝 MGE01600 Cear 「おんちからすーをおってうちゃんちどうかってううろって MGE01610 COMPUTE SINGLE SWITCH TINE AND CONTROL MGE01620 C C DCX=DCOS (THETA) NGE01630 DSA=DSIN(THETA) NGE01650 NGE01650

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FILE	MGEC	FORTRAN	P1	TH	E BRUWN	BICENTENNIA	L COMPUTER	CENTER
	DCB=DCO	S(BETA)					MGE	01660
	DSB=DS IN	(BETA)					MGEC	1670
	SB #=D SH-	-D SX					MGE	01680
	CHX=DCA-	-DC X					MGEO	1690
	DIETHEI	A-BETA		化化学学 化化学学			MGEO	1700
	DENCHAL	.00-(DS1)	INTENTOTE	**2+4.00*110	SINCOLE	2-0011##41/	DIE ##2 MGE	1710
	DISTIL	1 ( X 2 = DC B.	- X 1#DSR+ / X 1#	CRX+ 12# 56 1+1	-00-000	SIDIENI/DIEN	**21/DEMGE	11720
	CHOM		~1+0 JUT (A1.	CONTACTORT			MGE	1 730
	OL ST/21		- Y2 + 0C Y- (Y)	CAX + Y2#CAY-1	00+0005	(DIEN/DIE)	##21/DEMGE	1740
	0131121	-IIVI+D2V-		-CDA +A2+3 DA-1			MCE	1750
					DE INCOLO		MGEO	1760
	UM(1)=1		D 5 - 1 - 1 + 50			00-2 00+00	DC I DIE MCE	1770
	UM(2)=-/		-D 2Y-1 Y 1+ 281	- + + + + + + + + + + + + + + + + + + +	10177-12	2.00-2.00+00	USIDIFIMOE	11 700
	CITUIFIT						MUE	1700
	00 111 1	(=1,2					MGE	11790
	IFCCUMCH	().GT.0.DC	)).AND.(UM()	().LE.DENUMJ )	GO TO II		MGE	1800
C							MGE	01810
C MI	NIMAL MIS:	5 DISTANCE	E OCCURS AT	BOUNDARY POI	INT		MGE	01820
C							MGEC	01830
	IF((.NO	T.((UM(K))	.LE.0.D0).0	l.(K.EQ.1))).	OR. ( UM	(K).LE.0.DO)	.AND. (KMGE	)1840
	C.EQ.111	GO TO 11	8				MGEG	1850
	SWT1=1.	00					MGE	01 860
	SHT2=0.0	00					MGE	01870
	UPJ=(X1-	-SBX/DIF)	** 2+ (X 2+ CBX	/DIF)##2			MGE	01880
	UB=-DIF						MGE	01 890
	60 10 1	13					MGE	01900
118	SHT1=0.0	00					MGEL	1910
	SHT 2=1 .	10					MGE	01 92 0
	110 1= 1 ¥ 1	DCB1##24	1 12 AD SR 1 ##2				MGE	11930
	UN=0 00	0001++2+	1 A2 +0 30 1++2				MGE	11940
	CO TC 11	-					MGE	1 950
	00 10 11						NGE	11960
C		-	-				MCE	11070
C HI	NIMAL MIS	S DISTANC	E ULLUKS AT	SWITCH ITHE			HOE	1000
							MOE	11900
117	UPJ=DIS						MGE	11440
	IF IK .EQ	.1100 10	110				MGEL	2000
C							MUE	52010
COF	F-BANG CO	NTROL AND	SWITCH TIM	E ARE COMPUTE	EU		MGE	12020
C							MGE	2030
	SHT1=0.	00					MGE	02040
	SWT2=UM	2)/DENOM					MGE	02050
	UB=-DIF	(1.DO-SW	T2)				MGE	02 06 0
	GO TO 1	13					NGE	02070
C							MGE	2080
C BA	NG-OFF CO	NT ROL AND	SWITCH TIM	E ARE COMPUTE	ED		MGE	02 0 90
C							MGE	02100
116	SHT1=UM	(1)/DENOM					MGE	2110
	SWT2=1 .	00					MGE	02120
	UB=-DIF	SWT1					MGE	02130
113	RDIST=V	+DSORT (U	PJ)				MGE	2140
	IF(UPJ-	GE.OLJIGO	TO 111				MGE	02150
	OL J=UP.I						MGE	02160
	0541-54	11					MGE	02170
	0542-54	12					MGE	12180
	014=119	A starting the As					MGE	02190
111	CONTINU	2					MOE	02200
And the second se		the second se						

FILE: MGEO FURTRAN THE BROWN BICENTENNIAL COMPUTER CENTER P1 MGE02210 CONTINUE 115 TIS=OSW1 MGE02220 T2S=OSW2 MGE02230 MGE02240 USTAR=OU 3 FORMAT(1H0,6X, "N",9X, "PSI N",11X,"R",13X,"T1",12X,"T2",6X, "THETA MGE02250 CSTAR K',7X, 'U', 13X, 'E',/) MGE02260 4 FORMAT(1H ,5X ,12 ,1 X,7(014 .8,1X)) MGE02270 RETURN 102 MGE02280 MGE 022 90 END LAURTHOND + THEFE LOS 17 150 h 28 52

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