MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS 1942 A
An extensive literature survey on the field of inverse scattering as it applies to determining the spatial distribution of electron density in the ionosphere is presented. The references are primarily from the period 1970-1981. Abstracts are included.
INTRODUCTION

One of the tasks identified at the start of the research reported in this paper was to do a literature survey on the problem of applying inverse scattering techniques to determine the electron density distribution in the ionosphere. The primary motivation for this survey was to ensure that no potentially useful technique was overlooked in making the decision as to which approach to pursue.

The author has been professionally active in the inverse scattering and ionospheric probing fields for over 13 years. During this time, he has accumulated a library of over 1000 papers, reports, and books related to the topic of this survey. The first step in the survey was to review this library and extract those references which satisfied one or more of the following criteria:

1. The reference presents the fundamental information or an important aspect about an inverse scattering technique which was potentially applicable to the problem of interest.
2. The reference presents an inverse scattering technique which is well known, but is not applicable for one or more reasons evident from the material in the reference.
3. The reference includes material of interest in connection with the Exact Inverse Scattering Theory and related approaches discussed in this paper.
4. The reference presents material on the ionosphere of importance to applying inverse scattering theory to profile determination.

In addition, if a reference satisfied items 1, 2, and/or 4, but not item 3, then it was only included if it was felt to be "illustrative." Specifically, an attempt was made to avoid multiple references dealing with nearly identical material.
In an attempt to insure that material had not been omitted by the author, an extensive (but surprisingly inexpensive) computer aided literative search was next carried out. The following standard data bases were searched, using several nationwide systems accessed through the University of California, San Diego:

1. The Engineering Index ("Compendex")
2. The American Institute of Physics "SPIN" Index
3. The National Technical Information Service, (ITIS) index of government contract reports
4. "INSPEC"
5. Dissertation abstracts
6. The International Index of Conference Papers

These indexes are accessed using key words, singly and in combination. The numbers in Table 1 indicate the reference found in each index for each keyword. The search was carried out in November 1980. Printouts of the complete reference and abstract for Lines 1, 4, 5, 6, 9, 10, 11, 12, 13, and 14 of Table 1 were obtained. Searches on other combinations of keywords, directed toward ionospheric electron density profile determination without reference to inverse scattering resulted in matches that dealt with experimental and data processing techniques that were of little relevance to the purpose of the literature survey.

The 1032 abstracts which resulted from the above process were then examined individually, and subjected to the same selection criteria applied to the author's library. Where information in the abstract was insufficient, the original reference was consulted. All of those references chosen from the author's library were contained in the references found by the computer. This bespeaks a significant degree of exhaustiveness in the computer search. Those references in the final set with which the author was not familiar were studied.

The results of the literature survey, as reported in Volume I of this paper, was that the Exact Inverse Scattering Theory and the related techniques discussed in Volume I represent the best approach to pursue.

The final set of references, after the selection procedure, along with their abstracts, is presented on the following pages. The references are in chronological order, in so far as possible.
Table 1. Acoustic or Electromagnetic Methods of Inverse Scattering

<table>
<thead>
<tr>
<th>KEY WORDS</th>
<th>COMPENDEX</th>
<th>SPIN</th>
<th>NTIS</th>
<th>INSPEC</th>
<th>DISSERTATIONS</th>
<th>PAPERS</th>
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<tr>
<td>1. Inverse Scattering</td>
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<td>163</td>
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<td>6. Profile Reconstruction</td>
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<td>39</td>
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<td>10. 1 Combined with 3</td>
<td>4</td>
<td>3</td>
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<td>1</td>
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<td>2</td>
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</tbody>
</table>
Three possible D-region electron concentration profiles resulting from the July 9, 1962, 'Starfish' nuclear detonation are derived, using multiple frequency measurements of the absorption of cosmic radio noise. Two methods of profile determination are used. The first method uses both the classical magnetolonic theory of E. V. Appleton and the generalized magnetonic theory of H. K. Sen and A. A. Wyler. The second method uses only the classical theory of E. V. Appleton. The electron concentration height profiles obtained by the use of the two methods are then compared. 18 refs.

DESCRIPTORS: *IONOSPHERE.

IDENTIFIERS: EXPLOSIONS, Nuclear

INVERSE SCATTERING INVESTIGATION

Michigan Univ Ann Arbor Dept of Electrical Engineering (401548)

Quarterly rept. no. 2, 3 Apr-3 Jul 67
AUTHOR: Weston, Vaughan H.; LaRue, John H.
4221E2 Fl1: 20N USGDRR5805
Jul 67 38p
Rept No: 8579-2-0
Contract: F19628-67-C-0190

Abstract: The problem in question consists of determining means of solving the inverse scattering problem where the transmitted field is given and the received fields are measured, and this data is used to discover the nature of the target. The problem of what information can be determined about the body if the scattering matrix (phase and amplitude) is known only over an angular sector and measured in the far field, is studied further. Asymptotic analysis is used to show that in the high frequency case, portions of a piecewise smooth, convex surface can be found when knowledge of the bistatic scattered field is confined to a small cone. (Author)


Identifiers: Inverse scattering

AD-663 450 CFSTI Prices: PC A02/MF A01

SOME REMARKS CONCERNING A PATHOLOGICAL MATRIX OF INTEREST IN THE INVERSE-SCATTERING PROBLEM

Defense Research Corp Santa Barbara Calif (000000)

Revised ed
AUTHOR: Edmund, Peter J.
1725C4 USGDRR6509
30 Jun 64 2p
Contract: DA31 124 ARD094
Monitor: ARD-4157-2
Pub. in Journal of Mathematical Physics (U. S.) v5 n11 p1547-54 Nov 1964 (Copies not available to DOC or Clearinghouse customers).

Abstract: A Hermitian matrix which occurs in the theory of the quantum-mechanical inverse-scattering problem has apparently contradictory properties. It has a wellbehaved inverse in spite of having zero as one of its eigenvalues. The properties of the matrix are investigated and the relevance of the results to the theory are discussed. (Author)

Descriptors: (*MATRIX ALGEBRA. QUANTUM MECHANICS), (QUANTUM MECHANICS, SCATTERING), PHASE SHIFT. VECTOR ANALYSIS. SERIES

Identifiers: INVERSE SCATTERING

AD-612 527
INVERSE SCATTERING INVESTIGATION

Michigan Univ Ann Arbor Radiation Lab (294200)

Quarterly rept. no. 3, Jul-3 Oct 67
AUTHOR: Weston, Vaughan H.; Boerner, Wolfgang N.; Dolph, Charles L.
4382K4 Fld: 20N USGDR6808
Nov 67 87D
Rept No: 8579-3-0
Contract: F19628-67-C-0190
Monitor: ESO-TR-67-517-Vol-3
See also quarterly report no. 2, AD-663 450.

Abstract: The problem in question consists of determining means of solving the inverse scattering problem where the transmitted field is given and the received fields are measured, and this data is used to discover the nature of the target. Particular aspects of this overall problem are considered, such as the effect of phase errors upon the determination of the scattering surface, polynomial interpolation of the scattered field measured at a set of discrete points, and the testing of a numerical procedure for finding the surface of a conducting body from the knowledge of the near field. In addition, a review of exact theoretical treatments for the scalar inverse problem is given. (Author)


Identifiers: Inverse scattering. Far field, Near field

AD-665 857 CFSTI Prices: PC A05/MF A01

THE GENERALIZED POLARIZATION SCATTERING MATRIX

Syracuse Univ Research Corp N Y Special Projects Lab (339884)

AUTHOR: Bojarski, Norbert N.
A0895E2 Fld: 20N. 171. 60M. 63H USGDR7021
Dec 68 20p
Rept No: SPL-TR-68-71
Contract: F30602-68-C-0260

Abstract: The conventional definition of the monostatic monocromatic polarization matrix is first extended to the bistatic case, then to the short pulse case, and finally to the bistatic short pulse case. The transformations and convolutions involved are discussed in some detail. The method of determining the Least Square Best Estimate of the Generalized Polarization matrix from a set of measurements is then developed. It is shown that the Faraday rotation angles introduced by a magneto ionic medium intervening the radar and the target are determinable from measured short pulse monostatic polarization matrix data. It is then shown that the Least Square Best Estimate of the orientation angle of a symmetric target is also determinable from Faraday rotation contaminated short pulse monostatic polarization matrix data. (Author)


Identifiers: Inverse scattering. Faraday effect

AD-711 645 CFSTI Prices: HC A02/MF A01
Continuous and discrete inverse-scattering problems in a stratified elastic medium

ware JA: Aki K
Massachusetts Inst of Tech, Cambridge
Acoustical Soc America-J v 45 n 4 Apr 1969 p 91-21
Analytic solution and practical computational procedures for recovering properties of unknown elastic medium from waves reflected or transmitted through medium consisting of two homogeneous half-spaces in contact with heterogeneous region; results used to solve continuous inverse-scattering problem for stratified elastic half-space bounded by free surface.


Descriptors: (+sound, +scattering), lenses.
Identifiers: acoustic lenses
CARD ALERT: 751

069147 A6943812
An inverse scattering technique for electromagnetic bistatic scattering
Weston, V.H.; Boerner, W.M.
Univ. Michigan, Ann Arbor, USA
02
It is shown that the total field produced by a plane wave incident upon a scattering body can be expressed at all points in space as the sum of the incident field and the Fourier transform of a quantity which is related to the scattering matrix. For points exterior to the minimum convex surface enclosing the body, the scattered field is reducible to a plane-wave representation which requires knowledge of the bistatic scattered field, for a fixed frequency and direction of incidence.

Descriptors: scattering, E.M. waves
Section Class Codes: A0510

996560 A7702555
Formal solutions of inverse scattering problems. II
Prosser, R.T.
Dept. of Math., Dartmouth Coll., Hanover, NH, USA
Oct. 1976 Coden: JMAPAQ
Treatment: T
02
For pt. I see ibid., Vol. 10, p. 1819 (1969). The work of a previous paper, in which formal solutions of certain inverse scattering problems were developed, is continued to show that the solutions do in fact converge in certain cases of potential scattering for sufficiently weak potentials (7 refs).

Descriptors: Quantum Theory; Potential Scattering; Acoustic Wave Scattering.
Identifiers: inverse scattering; potential scattering; weak potentials; solution convergence; quantum scattering; acoustic wave scattering.
Section Class Codes: A0365N, A4320
Computational reconstruction of scattering objects from holograms

CARTER WH
Univ of Rochester, NY


Structural details are computed for a simple transparent object through holographic measurement of scattered monochromatic light. The complex disturbance of the scattered light is measured in amplitude and phase, along a line transverse to the illumination in the Fresnel zone of the object. The scattering potential of the object is then calculated along a parallel line using the field data and a new inverse scattering theory. Data are given for several scattering objects.

Two-dimensional inverse scattering problem

IMBRAILE WA; MITTRA R
TRW Systems Group, Redondo Beach, Calif


It is demonstrated that the knowledge of the incident field and the scattered far fields at one frequency may be employed to determine the size, shape, and location of a perfectly conducting scatterer. The reconstruction of the scattering body is accomplished via an analytic continuation procedure that generates the fields in the neighborhood of the scatter from the specified far-field distribution. The geometry of the body is then determined by locating a closed surface for which the total tangential electric field, i.e., the sum of the tangential components of the incident and scattered field, is zero. Where an exact knowledge of the entire far field is sufficient to determine the scatterer, a technique is also given for size and shape determination when only part of the far field is available.

DESCRIPTORS: (ELECTROMAGNETIC WAVES. Scattering).
CARD ALERT: 701, 711

INVESTIGATION OF A CLASS OF ELECTROMAGNETIC BOUNDARY VALUE PROBLEMS (FINAL REPT. FEB. 69-31 JAN 70)
MITTRA, R.

Issued by: ILLINOIS UNIV., URBANA, ILL., USA;

FEB. 1970

Availability: CFSTI. SPRINGFIELD, VA. 22151, USA

Treatment: T

Report No.: UIAL-70-4

USGRD No.: AD-707845

Contract No.: F19628-69-C-0015

APPLIES A CLASS OF NEWLY DEVELOPED TECHNIQUES TO THE SOLUTION OF PROBLEMS INVOLVING WAVEGUIDE DISCONTINUITIES, SCATTERING, AND DIFFRACTION AS WELL AS INVERSE SCATTERING PROBLEMS. ANOTHER OBJECTIVE WAS TO STUDY IMAGE PROCESSING AND INVERSE SCATTERING TECHNIQUES INVOLVING COHERENT FIELDS. A RATHER LARGE NUMBER OF WAVEGUIDE AS WELL AS OPEN-REGION BOUNDARY VALUE PROBLEMS HAS BEEN INVESTIGATED USING THE MODIFIED RESIDUE CALCULUS TECHNIQUE AND EXTENDED VERSIONS OF THE SAME. THE RELATIVE ADVANTAGES OF THESE METHODS OVER CONVENTIONAL NUMERICAL METHODS HAVE BEEN DEMONSTRATED. INVESTIGATION OF THE INVERSE SCATTERING PROBLEM BETWEEN PARALLEL PLANES HAS BEEN COMPLETED. THE INVERSE SCATTERING APPROACH HAS BEEN EXTENDED TO SOLVE THE PROBLEM OF SCATTERING FROM CYLINDERS OF ARBITRARY CROSS SECTION.

DESCRIPTORS: ELECTROMAGNETIC WAVE PROPAGATION; ELECTROMAGNETIC WAVE PROPAGATION GUIDED WAVES; SCATTERING ELECTROMAGNETIC WAVES; GUIDED ELECTROMAGNETIC WAVE PROPAGATION; ELECTROMAGNETIC WAVE SCATTERING

Identifiers: ELECTROMAGNETIC WAVES; BOUNDARY VALUE PROBLEMS; WAVEGUIDE DISCONTINUITIES; SCATTERING; DIFFRACTION; IMAGE PROCESSING; INVERSE SCATTERING TECHNIQUE; COHERENT FIELDS; MODIFIED RESIDUE CALCULUS; NUMERICAL ANALYSIS; HOLOGRAPHY

Section Class Codes: A0510, B2130
K-Space Formulation of the Electromagnetic Scattering Problem

Bojarski (Norbert N.) Moorestown N J (389 425)

Final rep. 1 Dec 69-31 May 70
AUTHOR: Bojarski, Norbert N.
C72734 Fld: 2ON, 171 d762 2
Mar 71 216p
Contract: F33615-70-C-1345
Project: AF-5546
Monitor: AFAL-TR-71-75
Distribution limitation now removed.

Abstract: The Electromagnetic Scattering problem is solved by means of a k-space formulation of the Electromagnetic Field equations, thereby replacing the conventional integral equation formulation of the scattering problem by a set of two algebraic equations in two unknowns in two spaces (the constitutive equation being an algebraic equation in x-space). These equations are solved by an iterative method executed with the aid of Fast Fourier Transform (FFT) algorithm connecting the two spaces, requiring very simple zero order initial approximations. Since algebraic and FFT equations are used, the number of arithmetic multiply-add operations and storage allocations required for a numerical solution is reduced from the order of N squared (for solving the matrix equations resulting from the conventional integral equations) to the order of N log(sub 2)N (where N is the number of data points required for the specification of the scatterer). The advantage gained in speed and storage is thus of the order of N/log(sub 2)N and N respectively. This method is thus considerably more efficient, and permits exact numerical solutions for much larger scatterers, than possible with the conventional matrix method. (Author)

Descriptors: (+Electromagnetic radiation, Scattering), Electromagnetic fields, Integral transforms, Integral equations, Partial differential equations, Matrices (Mathematics), Iterations, Numerical analysis, Radar cross sections

Identifiers: *Electromagnetic scattering, Fourier transformation, Fredholm equations, NTIS/DODXO AO-882 040/9ST
NTIS Prices: PC A10/MF A01

Two-dimensional inverse scattering problem
IMBRALE WA: MITTRA R
TRW Systems Group, Redondo Beach, Calif
It is demonstrated that the knowledge of the incident field and the scattered far fields at one frequency may be employed to determine the size, shape, and location of a perfectly conducting scatterer. The reconstruction of the scattering body is accomplished via an analytic continuation procedure that generates the fields in the neighborhood of the scatter from the specified far-field distribution. The geometry of the body is then determined by locating a closed surface for which the total tangential electric field, i.e., the sum of the tangential components of the incident and scattered field, is zero. Whereas exact knowledge of the entire far field is sufficient to determine the scatterer, a technique is also given for size and shape determination when only part of the far field is available.

Descriptors: (+ELECTROMAGNETIC WAVES, +Scattering), CARD ALERT: 701, 711
Plasma Inverse Scattering Theory

California Inst of Tech Pasadena Antenna Lab (030750)

Technical rept.
AUTHOR: Balanis, George N.
Dec 71
Rept No: TR-62
Grant: AF-AFOSR-1935-70
Project: AF-9768
Task: 976802

Abstract: The object of the report is to calculate the electron density profile of plane stratified inhomogeneous plasmas. The electron density profile is obtained through a numerical solution of the inverse scattering algorithm. The inverse scattering algorithm connects the time dependent reflected field resulting from a delta-function field incident normally on the plasma to the inhomogeneous plasma density. Examples show that the method produces uniquely the electron density on or behind maxima of the plasma frequency. It is shown that the delta-function incident field used in the inverse scattering algorithm can be replaced by a thin square pulse. (Author)

Descriptors: (Plasma medium, Electromagnetic waves), (Ionosphere, Electron density), (Scattering), Partial differential equations, Wave functions, Electrodynamics, Integral equations, Curve fitting, Graphics, Numerical analysis, Ionospheric propagation, Theses

Identifiers: *Inverse scattering, Maxwell's equations, Fourier transformation

AD-737 518  NTIS Prices: PC A07/MF A01

362361 A7214323, B7210365

Properties of Electromagnetic Pulse Scattering from a Grounded Dielectric Slab at Polarizing Incidence

Boerner, W.M.; Antar, Y.M.
Univ. Manitoba, Winnipeg, Canada
Inst. Electronics and Communication Engrs. Japan
Summaries of Papers 201-2 1971
1-3 Sep 1971 Sendai, Japan
Publ: Inst. Electronics and Communication Engrs. Japan
Tokyo, Japan 1976
Treatment: T 06

The inverse problem of scattering of an idealized electromagnetic square pulse from a lossy dielectric slab mounted on a perfectly conducting planar surface is investigated. The solution to the problem is facilitated by a Laplace Transform approach. The reflection coefficient is determined separately for the TE and the TM cases. The closed form solution of the inverse Laplace transform of the continuous wave partial reflection expansion is presented for the general lossless case of oblique incidence. The results indicate that the merits of a non-steady state inverse scattering approach are restricted to the slightly lossy case (3 Refs)

Descriptors: Electromagnetic scattering, Electromagnetic wave scattering

Identifiers: Electromagnetic pulse scattering, Grounded dielectric slab, Polarizing incidence, Laplace transform, Reflection coefficient, Lossless case of oblique incidence, Slightly lossy case

Section Class Codes: A0510, B2130
AN ELECTROMAGNETIC INVERSE SCATTERING IDENTIY, BASED ON THE PHYSICAL OPTICS APPROXIMATION, IS DEVELOPED FOR THE MONOSTATIC SCATTERED FAR FIELD CROSS SECTION OF PERFECT CONDUCTORS. UNIQUENESS OF THIS INVERSE IDENTITY IS PROVED. THIS IDENTITY REQUIRES COMPLETE SCATTERING INFORMATION FOR ALL FREQUENCIES AND ASPECT ANGLES. AN INTEGRAL EQUATION IS DEVELOPED FOR THE ARBITRARY CASE OF INCOMPLETE FREQUENCY AND/OR ASPECT ANGLE SCATTERING INFORMATION. A GENERAL CLOSED FORM SOLUTION TO THIS INTEGRAL EQUATION IS DEVELOPED, WHICH YIELDS THE SHAPE OF THE SCATTERER FROM SUCH INCOMPLETE INFORMATION. A SPECIFIC PRACTICAL RADAR SOLUTION IS PRESENTED. THE RESOLUTION OF THIS SOLUTION IS DEVELOPED, YIELDING SHORT-PULSE TARGET RESOLUTION PARAMETER EQUATIONS. SPECIAL CASES, SUCH AS A PRIORI KNOWLEDGE OF SCATTERER SYMMETRY, ARE TREATED IN SOME DETAIL. THE MERITS OF THIS SOLUTION OVER THE CONVENTIONAL RADAR IMAGING TECHNIQUE ARE DISCUSSED.

Descriptors: SCATTERING ELECTROMAGNETIC WAVES; ELECTROMAGNETIC WAVE SCATTERING; RADAR CROSS SECTIONS

Identifiers: ELECTROMAGNETIC INVERSE SCATTERING; PHYSICAL OPTICS APPROXIMATION; PERFECT CONDUCTORS; INTEGRAL EQUATION

Section Class Codes: AO5i0.
B2130.
B2710
NUMERICAL COMPUTATIONS IN THE INVERSE-SCATTERING PROBLEM AT FIXED ENERGY
SABATIER, P.C.; QUYEN VAN PHU, F.
UNIV. MONTPELLIER, FRANCE
PHYS. REV. D (USA) VOL.4, NO.1 127-32 JULY 1971

CONSTRUCTING POTENTIALS FROM THE PHASE SHIFTS AT A GIVEN ENERGY YIELDS AN INFINITY OF EQUIVALENT SOLUTIONS. THE DEVIATIONS OF THESE SOLUTIONS FROM EACH OTHER CAN, HOWEVER, BE ANALYZED ACCORDING TO A PRIORI LIMITATIONS ON THE DERIVATIVES AND OTHER FEATURES OF 'ACCEPTABLE' POTENTIALS. A SKETCH OF THIS ANALYSIS IS GIVEN TOGETHER WITH A NUMERICAL COMPARISON OF USUAL POTENTIAL FORMS WITH THE EQUIVALENT POTENTIALS OBTAINED THROUGH NEWTON'S METHOD. THE OBSERVED DEVIATION GIVES AN APPRAISAL OF THE DEVIATIONS FROM EACH OTHER OF ALL THE EQUIVALENT POTENTIALS WITH SIMILAR BOUNDS ON THE DERIVATIVES. THE DEVIATION IS SMALL WHEN THERE ARE MANY PHASE SHIFTS AVAILABLE, ALL OF THEM DEFINITELY SMALLER THAN PI/2. FOR A STATIC POTENTIAL THESE CONDITIONS CAN BE MET FOR HIGH ENERGIES.

A COHERENT-OPTICAL APPROACH TO THE INVERSE SCATTERING PROBLEM
SCHMIDT-WEINMAR, H.G.
UNIV. ALBERTA, EDMONTON, CANADA
CANADIAN ASSOC. PHYSICISTS
PHYS. CAN. (CANADA) VOL.27, NO.4 65 1971
CANCANIAN ASSOCIATION OF PHYSICISTS' ANNUAL CONGRESS 21-24 JUNE 1971 OTTAWA, ONTARIO, CANADA

USING A SEQUENCE OF THREE COHERENT OPTICAL REFERENCE FIELDS, MAGNITUDE AND PHASE OF SCATTERED LIGHT CAN BE DETERMINED FROM THE FAR-FIELD INTENSITY MEASURED AT VARIOUS SCATTERING ANGLES. THE RESULTS OF COMPUTER-SIMULATIONS OF A SCATTERING EXPERIMENT BASED UPON THIS PRINCIPLE ARE DISCUSSED. THE INVERSE COMPLEX SCATTERING MATRIX IS GIVEN FOR THE CASE OF A SEMI-TRANSPARENT, WEAKLY AND COHERENTLY SCATTERING THREE-DIMENSIONAL SYSTEM THAT CAN BE REPRESENTED BY A FINITE NUMBER OF SAMPLES OF THE COMPLEX SCATTERING POTENTIAL.

ASPECTS OF ELECTROMAGNETIC PULSE SCATTERING FROM A GROUNDED DIELECTRIC SLAB
BOERNER, W.M.; ANTAR, Y.M.
ARCH. ELEKTROM. UND UBERTRAGUNGSTECH. (GERMANY) VOL.26, NO.1 14-21 JAN. 1972

THE PROBLEM OF SCATTERING OF AN IDEALIZED ELECTROMAGNETIC SQUARE PULSE FROM A LOSSY DIELECTRIC SLAB MOUNTED ON A PERFECTLY CONDUCTING PLANAR SURFACE IS INVESTIGATED. FIRST THE LOSSLESS CASE IS TREATED IN DETAIL AND ALL THE REQUIRED FORMULATIONS ARE DERIVED. PARTICULAR EMPHASIS IS GIVEN TO THE STUDY OF THE REFLECTED AND REFRACTED PULSE RETURNS FROM THE GROUNDED SLAB AT BREWSTER ANGLE CONDITIONS. IT IS FOUND THAT THE DECOMPOSITION OF THE INITIALLY INCIDENT SINGLE PULSE INTO A SEQUENCE OF DELAYED PULSES REDUCES AT BREWSTER ANGLE CONDITIONS, TO ONLY ONE SINGLE PULSE RETURN WHICH IS PHASE DELAYED. THE ANALYSIS IS THEN EXTENDED TO THE LOSSY CASE.
THE TECHNIQUE IS PROVING THAT FOR SLIGHTLY LOSSY MATERIALS THE SAME ANOMALOUS BEHAVIOR IS ENCOUNTERED. A NOVEL SUITABLE MEASUREMENT TECHNIQUE IS PROPOSED AND PRESENTLY IS INVESTIGATED EMPLOYING A LASER SETUP (19 Refs).

Descriptors: SCATTERING/ELECTROMAGNETIC WAVES; DIELECTRIC PHENOMENA; ELECTROMAGNETIC WAVE SCATTERING; DIELECTRIC PROPERTIES

Identifiers: SCATTERING; ELECTROMAGNETIC SQUARE PULSE; LOSSY DIELECTRIC SLAB; GROUNDED SLAB; BREWSTER ANGLE; MEASUREMENT TECHNIQUE; LASER SETUP

Section Class Codes: A0510, B2130

472140 A7305723
K-SPACE FORMULATION OF THE ACOUSTIC SCATTERING PROBLEM
BOJARSKI, N.N.
DEPT. DEFENSE, MOORESTOWN, N.J., USA
LINDSAY, R.B. (Editors)
1972
PROGRAM OF THE 84TH MEETING OF THE ACOUSTICAL SOCIETY OF AMERICA. (ABSTRACTS ONLY) 102 1972
28 NOV. - 1 DEC. 1972 MIAMI BEACH, FLA., USA
Publ: ACoust. Soc. America NEW YORK, USA
120 PP
Treatment: T
06

Descriptors: ACOUSTIC WAVE SCATTERING
Identifiers: ACOUSTIC SCATTERING; FAST FOURIER TRANSFORM;
K-SPACE FORMULATION
Section Class Codes: A9820
Unified Class Codes: ZCCAAN

288899 ID NO.: E1721210900
ANTENNA SYNTHESIS AND SOLUTION OF INVERSE PROBLEMS BY REGULARIZATION METHODS.
Deschamps, Georges A.; Cabayan, Hrair S.
Univ of Illinois, Urbana
IEEE Trans Antennas Propag v AP-20 n 3 May 1972 p 268-274
CODEN: IETPAK
Antenna pattern synthesis is discussed as an example of solving improperly posed \$1eff\$ double quotes improperly posed \$right\$ double quotes problems. This serves the purpose of introducing a concept that is useful in many other applications: remote sensing, inverse scattering, etc. It also suggests that regulation methods can be devised to solve \$left\$ double quotes improperly posed \$right\$ double quotes problems improperly posed problems can be applied to antenna synthesis and the aforementioned problems. This gives systematic methods for solving the pattern synthesis problem even when the element patterns are arbitrary. 10 refs.

Descriptors: (\$antennas\$, \$radiation\$),
Identifiers: antenna pattern synthesis, regularization methods
CARD ALERT: 718
COMPLETE SOLUTION OF THE INVERSE SCATTERING PROBLEM AT FIXED ENERGY

SARATIEF, P.C.
UNIV. MONTPELLIER, FRANCE
J. MATH. PHYS., NEW YORK (USA) VOL. 13, NO. 5 675-99 MAY 1972 Coden: JMAPAQ
Treatment: T 02

LED OBE BE THE CLASS OF FUNCTIONS WHICH ARE BOUNDED BY CR/Sup -I+EPSILON/ AND CR/Sup -3-EPSILON/ AND R/Sup 2/ vSECONDS (R) BELONG TO O. E IS DENSE IN THE CLASS OF POTENTIALS V WITH FINITE NORM INTEGRAL/SUB 0//SUP INFINITY/RHO#V(RHO) dRHO IN WHICH ALMOST ALL THE RESULTS OF POTENTIAL SCATTERING ARE DERIVED. IN THIS PAPER A COMPLETE SOLUTION OF THE INVERSE SCATTERING PROBLEM AT FIXED ENERGY IS GIVEN IN A CLASS E/Sup */ OF POTENTIALS WHICH CONTAINS E. THIS MEANS THAT GIVEN ANY SET OF PHASE SHIFTS BOUNDED BY CL/Sup -1-EPSILON/ THE AUTHOR CONSTRUCTS ALL THE POTENTIALS OF E/Sup */ WHICH FIT THIS SET OF PHASE SHIFTS. THEY DEPEND ON AN ARBITRARY FUNCTION. THE FUNDAMENTAL TOOL IN THE SOLUTION IS THE 'SCATTERING STRUCTURE FUNCTION'. THE METHOD IS DERIVED IN SUCH A WAY THAT AN APPROXIMATION THEORY AND NUMERICAL COMPUTATIONS ARE FEASIBLE. THESE TOGETHER WITH VARIOUS STUDIES OF THE SOLUTIONS, ARE THE OBJECT OF FORTHCOMING PAPERS (51 Refs)

Descriptors: SCATTERING; QUANTUM THEORY WAVF EQUATION

Identifiers: INVERSE SCATTERING PROBLEM; FIXED ENERGY; CLASS OF FUNCTIONS; CLASS OF POTENTIALS; PHASE SHIFTS; SCATTERING STRUCTURE FUNCTION; APPROXIMATION THEORY; SCHROEDINGER EQUATION

Section Class Codes: A0220

TEMPERATURE PROFILE DETERMINATION IN AN ABSORBING PLASMA

USHER, J.L.; CAMPBELL, H.O.
UNIV. FLORIDA, GAINESVILLE, USA
J. QUANT. SPECTROSC. AND RADIAT. TRANSFER (GB) VOL. 12 NO. 7 1157-60 JULY 1972 Coden: JOSRAE
Treatment: TX 02

A NEW METHOD HAS BEEN DEVELOPED TO DETERMINE THE TEMPERATURE PROFILE OF AN OPTICALLY-NON-THIN PLASMA. THE TECHNIQUE IS ESSENTIALLY AN EXTENSION OF THE BRIGHTNESS-EMISSIVITY METHOD TO THE CASE OF A CYLINDRICALLY-SYMMETRIC PLASMA (7 Refs)

Descriptors: PLASMA DIAGNOSTIC; TEMPERATURE MEASUREMENT

Identifiers: OPTICALLY NON THIN PLASMA; BRIGHTNESS EMISSIVITY METHOD; TEMPERATURE PROFILE DETERMINATION; ABSORBING PLASMA

Section Class Codes: A1424

INDIRECT VERTICAL PROFILE DETERMINATION OF THE ATMOSPHERIC MOISTURE CONTENT

BOGOBOLOV, O.S.; PANIN, B.D.
IVV. AKAH, NAM 555R FIZ. ATMOS. AND OKEANA VOL. 9, NO. 4 363-70 APRIL 1973 Coden: IFAOA
Trans in: BULL. ACAD. SCI. USSR. ATMOS. AND OCEANIC PHYS. SER. (USA) VOL. 9, NO. 4 Coden: BSUAAZ
Treatment: T 02

Languages: RUSSIAN


Descriptors: ATMOSPHERIC HUMIDITY; MOISTURE; ATMOSPHERIC SPECTRA

Identifiers: INDIRECT VERTICAL PROFILE DETERMINATION; ATMOSPHERIC MOISTURE CONTENT; SPECTRAL COMPOSITION DATA; 6.3 MICRON H/Sup 2/ O VAPOUR ABSORPTION BAND

Section Class Codes: A9340
Unified Class Codes: ZKKACE
AN EXACT PROBLEM OF E.M. INVERSE SCATTERING IS CONSIDERED FOR WHICH THE TARGET CHARACTERISTICS OF UNKNOWN SCATTERERS NEED TO BE DETERMINED. IT IS ASSUMED THAT THE INCIDENT AND THE SCATTERED FIELDS ARE GIVEN EVERYWHERE AND THAT THE LAWS OF INTERACTION SATISFY THE LEONTOVICH CONDITION. TO RECOVER THE A PRIORI UNKNOWNS, I.E. THE EXACT SURFACE LOCI OF DISCONTINUITIES IN MATERIAL CONSTITUTIVES AND THEIR EXACT VALUES, THE CONCEPT OF E.M. INVERSE BOUNDARY CONDITIONS IS EMPLOYED. NAMELY, TWO BASIC UNIQUE VECTORS $A\equiv E_\perp - \zeta_\perp E_\perp $ AND $B\equiv E_\perp \times H - \zeta_\perp E_\perp \times H$ CAN BE DERIVED FROM INVERSION OF THE LEONTOVICH CONDITION WHICH LIE IN THE LOCAL SCATTERING PLANE, ARE ORTHOGONAL AND OF IDENTICAL MAGNITUDE, WHERE $E$ AND $H$ DENOTE THE TOTAL ELECTRIC AND MAGNETIC VECTORS, $\zeta$ THE LOCAL AVERAGED SURFACE IMPEDANCE, AND THE QUANTITIES WITH ASTERISKS REPRESENT THE COMPLEX CONJUGATES. THUS TWO INDEPENDENT NECESSARY, NOT LOCALLY BUT GLOBALLY SUFFICIENT CONDITIONS $A^* B = 0$ AND $A^*/|A^*|^2 - B^*/|B^*|^2 = 0$ EXIST WHICH CAN BE EMPLOYED TO UNIQUELY RECOVER THE CHARACTERISTIC PARAMETERS OF CONDUCTING SHAPES.

Descriptors: ELECTROMAGNETIC WAVE SCATTERING; BOUNDARY VALUE PROBLEMS

Identifiers: ELECTROMAGNETIC INVERSE BOUNDARY CONDITIONS; TARGET CHARACTERISTICS; LEONTOVICH CONDITION; LOCAL SCATTERING PLANE; MAGNETIC VECTORS; SURFACE IMPEDANCE; ELECTRIC VECTORS

Section Class Codes: A2246, B3144

Unified Class Codes: EC3 VW
Inverse Scattering

Bojarski (Norbert N) Moorestown N J (389 425)

Final rept.
AUTHOR: Bojarski, Norbert N.
C735284  Fld: 171  d7622
Apr 73  106p
Contract: NO0019-72-C-0482
Monitor: 18
Distribution limitation now removed.

Abstract: A three-dimensional electromagnetic Inverse Scattering identity, based on the Physical Optics approximation, is developed for the monostatic scattered far field cross section of perfect conductors. Uniqueness of this inverse scattering identity is proven. This identity requires complete scattering information for all frequencies and aspect angles. A non-singular integral equation is developed for the arbitrary case of incomplete frequency and/or aspect angle scattering information. A general closed form solution to this integral equation is developed, which yields the shape of a scatterer from such incomplete information. A specific practical radar solution is presented. The resolution of this solution is developed, yielding short-pulse target resolution radar system parameter equations. The general inverse scattering and radiation problem associated with the three-dimensional inhomogeneous scalar field Helmholtz wave equation is formulated as a Fredholm integro-differential equation of the second kind. The far-field inverse integro-differential equation is solved in closed form with the aid of a single resolvent integral operator, which can be readily evaluated numerically with the aid of the fast Fourier transform algorithm. The inverse integro-differential equation and its solution are then generalized to the reduced vector wave equation resulting from Maxwell’s equations. A formal statement of the inverse problem is presented. It is shown that the first order Neumann series solution of the inverse integro-differential equation as well as the first order term of its exact solution represent the physical optics approximation and the equations governing synthetic microwave holography.


Identifiers: Inverse scattering. NTISDDXJD

AD-910 661/8ST   NTIS Prices: PC AO6/MF AO1
The Discrete Inverse Scattering Problem in One Dimension

Rockefeller Univ New York Dept of Physics (405310)
AUTHOR: Case, K. M.
C3123C4 Fld: 20J GRA17417
18 Jun 73 6p
Grant: AF-AFOSR-2187-72
Project: AF-9767
Task: 976702
Monitor: AFOSR-TR-74-0858
Availability: Pub. in Jnl. of Mathematical Physics, v15 n2 p143-146 Feb 74.

Abstract: A discrete version of the inverse scattering problem in one dimension is considered. While the natural formulation is somewhat different from the three-dimensional problem with spherical symmetry, the equations of solution turn out to be almost identical. Indeed, in the continuous limit (Schrodinger equation) even the slight differences disappear. Two equivalent treatments corresponding to considering incidence from left to right are given. For actual computation a combination of the two seems most efficient. (Author)

Descriptors: *Quantum theory, Matrices(Mathematics), Schrodinger equation

Identifiers: *Inverse scattering, NTIS000AF

AD-781 119/3 NTIS Price: Reprint

On Discrete Inverse Scattering Problems. II

Rockefeller Univ New York Dept of Physics (405310)
AUTHOR: Case, Kenneth M.
C244113 Fld: 20J GRA17408
23 Jan 73 6p
Grant: AF-AFOSR-2187-72
Project: AF-9767
Task: 976704
Monitor: AFOSR-TR-74-0165
Availability: Pub. in Jnl. of Mathematical Physics, v14 n7 p916-920 Jul 73.

Abstract: A discrete version of the inverse scattering problem of the Schrodinger equation with a potential is discussed. The approach is via the Marchenko equation. Interest is primarily pedagogical. All steps are elementary and relatively obvious. Passage to the continuous case as a limit is heuristically straightforward. An example shows how the formalism does produce the potential from scattering data. (Author)

Descriptors: *Potential scattering, *Schrodinger equation, Eigenvectors

Identifiers: *Inverse scattering, Eigenvalues, Marchenko equation, AF

AD-774 421/2 NTIS Price: Reprint
ON DISCRETE INVERSE SCATTERING PROBLEMS. II

CASE, K. M.
ROCKEFELLER UNIV., N.Y., USA
J. MATH. PHYS., NEW YORK (USA) VOL. 14, NO. 7 916-20
JULY 1973 Coden: JNAPAO

Treatment: T

02 FOR PT. I SEE ABSTR. A35589 OF 1973. THE DISCRETE VERSION OF
THE SCHRODINGER POTENTIAL PROBLEM IS FORMULATED, AND THE
INVERSE SCATTERING PROBLEM IS SOLVED FORMALLY USING THE
MARCHENKO EQUATION: A WORKED EXAMPLE IS GIVEN AND THE
CONTINUOUS LIMIT IS FOUND (7 Refs)

Descriptors: QUANTUM THEORY; SCATTERING; SCHRODINGER
EQUATION

Identifiers: SCHRODINGER POTENTIAL PROBLEM; MARCHENKO
EQUATION; CONTINUOUS LIMIT; DISCRETE INVERSE SCATTERING
PROBLEMS

Section Class Codes: A1400
Unified Class Codes: DAAK7Y

525290 A739549, B7324888
TRANSFER FUNCTIONS OF SOME IONOSPHERIC MODELS
CHECCACCI, P.F.; SCHEGGI, A.M.
CONSIGLIO NAZIONALE RICERCHE, FLORENCE, ITALY
IEEE TRANS. ANTENNAS AND PROPAG. (USA) VOL. AP-21, NO. 3
400-2 MAY 1973 Coden: IETPAK
Treatment: G

02 THE SPATIAL IMPULSE RESPONSE FUNCTIONS OF SIMPLE IONOSPHERIC
MODELS ARE COMPUTED USING A RAY-TRACING TECHNIQUE. SUCH
FUNCTIONS SHOW MEASURABLE DEPENDENCE ON THE SINGLE PARAMETERS
CHARACTERIZING THE ASSUMED PROFILE. HENCE THE SOLUTION OF THE
INVERSE PROBLEM (I.E., TO DETERMINE THE PROFILE OF THE
IONOSPHERE FROM A MEASURED IMPULSE RESPONSE FUNCTION) SEEMS
FEASIBLE (3 Refs)

Descriptors: IONOSPHERE; TRANSIENT RESPONSE; IONOSPHERIC
MEASUREMENTS; MODELLING

Identifiers: SPATIAL IMPULSE RESPONSE FUNCTIONS; IONOSPHERIC
MODELS; RAY TRACING; IONOSPHERE PROFILE DETERMINATION

Section Class Codes: A9360, A93R2, B4820
Unified Class Codes: ZKRAAW, ZKVCAE

56521S A7366948
RADIATING AND NONRADIATING CLASSICAL CURRENT DISTRIBUTIONS
AND THE FIELDS THEY GENERATE
DEVANEY, A. J.; WOLF, E.
UNIV. ROCHESTER, N.Y., USA

PHYS. REV. D (USA) VOL. 8, NO. 4 1044-7 15 AUG. 1973
Coden: PRVDAO

Treatment: T

02 SEVERAL GENERAL THEOREMS ARE ESTABLISHED RELATING TO
WELL-BEHAVED, LOCALIZED, MONOCHROMATIC CURRENT DISTRIBUTIONS
AND THE FIELDS THAT THEY GENERATE. IN PARTICULAR, A NECESSARY
AND SUFFICIENT CONDITION FOR SUCH A CURRENT DISTRIBUTION TO BE
NONRADIATING IS ESTABLISHED AND A GENERAL EXPRESSION FOR ALL
NONRADIATING CURRENT DISTRIBUTIONS OF THIS CLASS IS OBTAINED
(12 Refs)

Descriptors: CURRENT ALGEBRA; ELECTROMAGNETIC FIELD THEORY

Identifiers: CLASSICAL CURRENT DISTRIBUTIONS; FIELDS:
GENERAL THEOREMS; NONRADIATING

Section Class Codes: A3140, A3390
Unified Class Codes: GBBKACH, GFZAAAA
An application of one-dimensional inverse-scattering theory for inhomogeneous regions.

Jordan, A. K.; Kritikos, H. N.

Univ of Pa, Philadelphia

IEEE Trans Antennas Propag v AP-21 n 6 Nov 1973 p 909-911

CODEN: IETPAK

One-dimensional inverse-scattering theory is applied to the study of the reflection of electromagnetic waves from an inhomogeneous region. The exact refractive index profile is obtained that will produce a reflection coefficient in which the frequency dependence is described by the Butterworth approximation. The physical model used may be applied in the study of the scattering of millimeter waves by semiconductor surfaces. 13 refs.

Descriptors: (+Electromagnetic waves. +Scattering).

Card Alert: T71

605943 A7408764. B7406840. C7405896

Inverse scattering and remote probing

Mitra, R.

UNIV. ILLINOIS, URBANA, USA

Mitra, R. (Editors)

Computer techniques for electromagnetics 351-97 1973

Publ: Pergamon Oxford, England

ISBN 0 08 016888 4

Treatment: T 04

Though there exists a large body of literature dealing with the 'forward' scattering problem, the number of works dealing with the inverse problem is relatively few. This is due primarily to the complexities associated with the inverse problem. Many of the inverse problems do not lend themselves to formulation in terms of linear matrix or integral equations, and consequently, sophisticated techniques are required to resolve them. Even when it is possible to describe the inverse problem in terms of a linear matrix equation, the resulting equation is often ill-conditioned, and its inverse unstable. Special techniques are again necessary to handle these cases. To introduce some of the computer techniques found useful for solving inverse problems, the paper discusses five illustrative problems in this category (14 Refs)

522400 A7337854

The three-dimensional inverse scattering problem for the Helmholtz equation

Sleeman, B.D.

UNIV. DUNDEE, SCOTLAND


CODEN: PCPSA4

Treatment: T 02

The author examines solutions of the three-dimensional Helmholtz equation which are of class C/sup 2/ (i.e. regular) in the exterior of a bounded domain D. In cylindrical polar coordinates (r, z, phi) such solutions satisfy the equation Delta/sup 2/psi + k^2 psi = 0, in which the wave number is normalized to unity and k satisfies the Sommerfeld radiation condition lim/sub r->infinity/ r^2(Delta + Delta + iu)(r^2/2 + k^2/2) (17 Refs)

Descriptors: electromagnetic wave scattering: partial differential equations

Identifiers: Helmholtz equation; cylindrical polar coordinates; Sommerfeld radiation condition; three dimensional inverse scattering problem

Section Class Codes: A1380

Unified Class Codes: DDKAAK
INVERSE SCATTERING TRANSFORM-FOURIER ANALYSIS FOR NONLINEAR PROBLEMS.
Ablowitz, Mark J.; Kaup, David J.; Newell, Alan C.; Segur, Harvey
Clarkson Coll of Technol, Potsdam, NY
Stud Appl Math v 53 n 4 Dec 1974 p 249-315 CODEN: SAPM86
A comprehensive presentation of the inverse scattering method is given and general features of the solution are discussed. The relationship of the scattering theory and Backlund transformations is brought out. In view of the role of the dispersion relation, the comparatively simple asymptotic states, and the similarity of the method itself to Fourier transforms, this theory can be considered a natural extension of Fourier analysis to nonlinear problems. 63 refs.

DESCRIPTORS: (*MATHEMATICAL TECHNIQUES, *Nonlinear Equations

RECENTLY DEVELOPED FORMULATIONS OF THE INVERSE PROBLEM IN ACOUSTICS AND ELECTROMAGNETICS
BLEISTEIN, N.; BOJARSKI, N.N.
Issued by: DENVER RES. INST., COLO., USA;
DEC. 1974
37
Availability: NTIS, SPRINGFIELD, VA. 22161, USA
Treatment: T
11
Report No.: MS-R-7501
Contract No.: N00014-87-A-0391-0005
THERE ARE TWO TYPES OF FORMULATIONS, ONE IN THE GEOMETRICAL OPTICS LIMIT AND THE OTHER, AN EXACT FORMULATION FOR THE INVERSE SOURCE PROBLEM, BOTH BASIC FORMULATIONS ARE EXTENDED TO INCLUDE THE REALISTIC PROBLEM OF A 'LIMITED APERTURE' OF OBSERVATIONS. IT IS ALSO SHOWN THAT THE INVERSE SOURCE FORMULATION CAN BE APPLIED TO THE PROBLEM OF RECONSTRUCTION OF MEDIA INHOMOGENEITIES FROM REMOTELY SENSED FIELD DATA. THE BASIC PHYSICAL OPTICS RESULT IS THAT THE CHARACTERISTIC FUNCTION OF THE SCATTERING OBSTACLE AND THE PHASE AND RANGE NORMALIZED SCATTERING AMPLITUDE ARE A FOURIER TRANSFORM PAIR. ALL OTHER FORMULATIONS LEAD TO FREDHOLM INTEGRAL EQUATIONS OF THE FIRST KIND.

DESCRIPTORS: ELECTROMAGNETISM; ACOUSTICS; PHYSICAL OPTICS; ELECTROMAGNETIC WAVE SCATTERING; ACOUSTIC WAVE SCATTERING; GEOMETRICAL OPTICS; ACOUSTIC APPLICATIONS; FOURIER TRANSFORMS

IDENTIFIERS: INVERSE PROBLEM; ACOUSTICS; GEOMETRICAL OPTICS; INVERSE SOURCE PROBLEM; MEDIA INHOMOGENEITIES; FREDHOLM INTEGRAL EQUATIONS; ELECTROMAGNETISM; FOURIER TRANSFORM PAIR; OBSERVATIONS LIMITED APERTURE; PHYSICAL OPTICS; SCATTERING OBSTACLE CHARACTERISTIC FUNCTION; NORMALIZED SCATTERING
Inverse Scattering

Bojarski (Norbert N.), Moorestown, N.J. (389 425)

Final rept.
AUTHOR: Bojarski, Norbert N.
C251501 Fld: 20N GRA17409
Feb 74 200
Contract: N00019-73-C-0312
Monitor: 18
See also AD-910 661.

Abstract: The Physical Optics and Exact Inverse Scattering solutions of this author are summarized. For the Physical Optics Inverse Scattering Method, shown are computer-reconstructed images of a sphere and cylinder from computer synthetic scattering data, as well as a sphere from experimentally measured data. For the exact Inverse Scattering Method, shown are computer-reconstructed source distributions (currents) of a half wave dipole antenna, a point-source, and two point-sources separated by one-half-wavelength, from computed synthetic scattering data. (Author)

Descriptors: *Electromagnetic scattering, Dipole antennas, Computer graphics, Integral equations

Identifiers: Inverse scattering, N

AD-775 235/5 NTIS Prices: PC A02/W A01

Reconstruction of Inhomogeneous Scattering Objects from Holograms.
Carter, William H.; Ho, Pin-Chin
US Nav Res Lab, Washington, DC
Appl Opt v 13 n 1 Jan 1974 p 162-172 CODEN: APOPAI
An experiment is reported in which the one-dimensional scattering potential along a line through a semitransparent bar with nonuniform index of refraction is determined from holographic measurements of scattered monochromatic light waves. The experiment is performed using an inhomogeneous bar for the first time in order to test quantitatively a recently developed inverse scattering theory. This theory suggests a method by which the three-dimensional structure of a semitransparent, weakly scattering object can be determined by means of light scattering experiments. The structural data obtained in this experiment agree with known object parameters to within errors of the order of a few percent. In addition, a problem that occurred in earlier experiments concerning the presence of an unwanted background is analyzed. A method for removing the background is described. 10 refs.

Descriptors: *HOLOGRAPHY, (LIGHT, Scattering).

Discrete Inverse Scattering Problem in One Dimension
Case, K. M.
ROCKEFELLER UNIV., N.Y., USA
Treatment: T

Languages: ENGLISH

Descriptors: S-MATRIX THEORY
Identifiers: DISCRETE INVERSE SCATTERING PROBLEM; ONE DIMENSION; S-MATRIX CONTINUOUS LIMIT
Section Class Codes: A3120
Unified Class Codes: QBEACV
Given the scalar fields incident upon and scattered from a finite inhomogeneous region exhibiting arbitrary spatial variations of refractive index it is shown how to construct a determinant which depends only on the refractive index within the scattering region and the fields outside this region. The analysis is simpler, and of wider applicability, than the Gel'fand-Levitan technique (5 Refs).

Descriptors: Acoustic wave scattering; Quantum theory; Electromagnetic wave scattering; Scalar inverse scattering problem; Finite inhomogeneous region; Arbitrary spatial variations of refractive index; Global solution; Incident scalar fields.

Non-uniqueness in the inverse source problem in acoustics and electromagnetics

Abstract: It is shown that there exist physically realizable acoustic and electromagnetic sources for which the radiated field is exactly zero. Alternative analytical characterizations of these non-radiating sources are presented. Recently developed formulations of the inverse problem in acoustics and electromagnetics are introduced. The source is given as a solution of a Fredholm integral equation of the first kind. It is shown that the null space for this integral equation in each case is the class of non-radiating sources.


Identifiers: Inverse problems, Fredholm equations, NTISDDON.
Reformulation of the Plasma Inverse Scattering Problem

Naval Research Lab Washington D.C. (251950)

Interim rept.
AUTHOR: Szu, H. Harold; Carroll, C. E.; Ahn, Saeyoung
C536203 Fld: 201 GRA17524
Aug 75 14p
Rept No: NRL-MR-3108
Project: NRL-B00-41, RRO14-02
Task: RRO14-02-41
Monitor: IS

Abstract: The one-dimensional problem of determining the density of a plasma from the reflection of electromagnetic waves has been solved by the Gel'fand-Levitan technique. Here their integral equation is modified and simplified. Laplace transformation gives a simple functional equation, and the asymptotic form of its solution yields the plasma density.


Identifiers: Inverse problems. NTISDDON
AD-A015 303/IST NTIS Prices: PC A02/MF A01

547680 ID NO.- E1750747680
ON THE FEASIBILITY OF AN INVERSE SCATTERING METHOD.
Tabbara, W.
Ec Super d'Electr, Paris, Fr
IEEE Trans Antennas Propag v AP-23 n 3 May 1975 p 446-448
CODEN: IETPAK

This communication continues the investigation of R. Lewis' inverse scattering method. The purpose is first to show that the previously mentioned results can be significantly improved and then to point out the requirements for an experimental setup.

CARD ALERT: 716, 711

598443 ID NO.- E1750638443
TWO RECONSTRUCTION METHODS FOR MICROWAVE IMAGING OF BURIED DIELECTRIC ANOMALIES.
Yue, On-Ching; Rope, E. L.; Tricoles, G.
Gen Dyn, San Diego, Calif
IEEE Trans Comput v C-24 n 4 Apr 1975 p 381-390 CODEN: ITCOB4

Microwave imaging of anomalies, such as voids or discontinuities, in optically opaque regions is described. Images were reconstructed with two techniques. The experimental technique utilized laser light for reconstructions from detour phase holograms that encoded data measured in the region of Fresnel diffraction. Examples of images are presented for smooth and rough interfaces. The numerical reconstruction technique was based on the angular spectrum technique, and an approximate propagator was derived to describe propagation through two, homogeneous dielectric layers to one anomaly. Image quality was acceptable for either reconstruction method, but the optically reconstructed images are rather small because scale reduction is limited in practice. 14 refs.

DESCRIPTORS: *HOLOGRAPHY, ELECTROMAGNETIC WAVES.
IDENTIFIERS: MICROWAVE IMAGING, MICROWAVE HOLOGRAPHY
CARD ALERT: 716, 743
Solution of the Inverse Scattering Problem by the Newton Method

Joint Inst. for Nuclear Research, Dubna (USSR). (3470000)
AUTHOR: Zhidkov, E. P.; Malyshev, R. V.; Khristov, E. Kh.
G1675E4 Flc: 20J. 46 GRA18018
1975 38p
Language: RUSSIAN
In Russian - U.S. Sales Only.

Abstract: A simple convergent process for the construction of the potential in Schrodinger equation for the scattering phase shift. Using Tikhonov regularization, a stable computing scheme is obtained. (Atomindex citation 10:431290)

Descriptors: Inverse scattering problem, Accuracy, Iterative methods, Mathematical space, Numerical solution, Phase shift, Potential scattering, Projection operators, Schrodinger equation

Identifiers: ERDA/657002, Newton method, NTISINIS, NTISFMUR
JINR-R-S-9063 NTIS Prices: PC A03/MF A01

74092292 v2n10
Subsurface electrical profile determination
Lytie, R.J.
SECTION HEADING: ELECTRONICS ENGINEERING
Section Class Codes: 4000

74105075 v2n11
Subsurface electrical profile determination--theory & experiment
Lytie, R.J.
SECTION HEADING: ELECTRONICS ENGINEERING
Section Class Codes: 4000
A variety of C.W. and swept frequency experiments were performed in a permafrost region of the Brooks Range in Alaska. Two drill holes, 600 feet (180m) deep and separated by 550 feet (170m) permitted hole-to-hole and surface-to-hole transmission measurements. Amplitude and phase information was recorded for frequencies of 1-50 MHz. This data permitted determination of the conductivity sigma and dielectric constant epsilon of the subsurface medium between the drill holes for a variety of frequencies. As measurements were taken for numerous depths and relative orientations of source and receiver (both downhole and on the surface), a detailed subsurface profile was obtainable. Least square matrix methods were used to invert the data. Various ways of combining the data yielded equivalent subsurface profiles. A discussion of the experimental method, experimental results, theoretical basis of the experiment, data reduction method, and data results are presented.

Descriptors: Terrestrial Electricity; Geophysical Techniques; Electrical Conductivity Measurement; Permittivity Measurement; Soil

Identifiers: Subsurface Electrical Profile Determination; Swept Frequency Experiments; Permafrost; Alaska; Conductivity; Dielectric Constant; Equivalent Subsurface Profiles; Least Square Matrix Data Inversion; CW Experiments

Section Class Codes: A9380, B4800, A0660, B4427
Unified Class Codes: ZKVAAT, 8GMAAH, BKCRAG

509088 ID NO.- E1750209088
ON THE BOJARSKI-LEWIS INVERSE SCATTERING METHOD.
Perry, William L.
USAF Aerosp Res Lab
CODEN: IETPAK

The authors assume that the backscattered electromagnetic far-field of a perfectly conducting scatterer is known for all aspects and for frequencies greater in magnitude than some positive number m. Then using standard integral equation techniques, they show how numerical instability enters into the N. Bojarski-R. Lewis inverse scattering method. Since the assumed knowledge of the backscattered field is even more complete than can be expected with radar, these results show that for radar applications the Bojarski-Lewis method is numerically unstable. Moreover, the degree of instability depends directly upon m. The more low frequency information one has, (i.e., the smaller m is), the more stable the method is. In the concluding remarks is noted a recent constrained Bojarski-Lewis method that overcomes much of the instability of the original unconstrained method studied here.

25 refs.

Descriptors: (+Electromagnetic Waves, *Scattering), (Radar, Reflection).
CARD ALERT: 711, 716
THE COEFFICIENTS OF A HYPERBOLIC DISPERSIVE PARTIAL DIFFERENTIAL EQUATION WERE PREVIOUSLY SHOWN TO BE GIVEN IN TERMS OF A DUAL SET OF INTEGRAL EQUATIONS INVOLVING MEASURABLE QUANTITIES AND THE KERNELS OF THE REFLECTION AND TRANSMISSION OPERATORS. TO DETERMINE AN UNKNOWN PARAMETER OF THESE EQUATIONS AN AUXILIARY EQUATION IS USED. THE UNIQUENESS OF THE SOLUTION OF THE RESULTANT SYSTEM IS SHOWN FOR A CERTAIN CLASS OF PROBLEMS. THE USE OF AN ADDITIONAL EQUATION RESULTS IN UNIQUENESS UNDER VERY GENERAL CONDITIONS (3 Refs).

Descriptors: SCATTERING; INTEGRAL EQUATIONS

Identifiers: INVERSE SCATTERING; HYPERBOLIC DISPERSIVE PARTIAL DIFFERENTIAL EQUATION; DUAL SET OF INTEGRAL EQUATIONS; TRANSMISSION OPERATORS; UNIQUENESS; REFLECTION OPERATORS
ON THE INVERSE SCATTERING PROBLEM FOR THE EQUATION OF ACOUSTICS

AVILA, G.S.S.
DEPT. DE MATEMATICA, INST. DE CIENCIAS EXATAS, UNIV. DE BRASILIA, BRASILIA, BRAZIL
AN. ACAD. BRAS. CIENC. (BRAZIL) VOL. 48, NO. 4 663-6 1976

Coden: AABCAD
Treatment: THEORETICAL-
JOURNAL PAPER-

IT IS SHOWN THAT RESULTS (MENZLA (1976)) FOR THE INVERSE SCATTERING PROBLEM FOR THE EQUATION U/SUB T/DELTAU+U(X)=0 CAN BE EXTENDED TO THE ACUSTIC EQUATION U/SUB T/DELTAU+U(X)=0 IN A NONHOMOGENEOUS MEDIUM OF VARIABLE DENSITY U(X) IS CONSIDERED AS A PERTURBATION OF PROPAGATION IN A HOMOGENEOUS MEDIUM OF CONSTANT DENSITY U=1 (6 Refs)

Descriptors: INVERSE SCATTERING PROBLEM; ACOUSTIC EQUATION; NONHOMOGENEOUS MEDIUM; ACOUSTIC WAVE PROPAGATION

Section Class Codes: A4320

AN EXTENDED RYTOV APPROXIMATION AND ITS SIGNIFICANCE FOR REMOTE SENSING AND INVERSE SCATTERING

BATES, R.H.T.; BOERNER, W.M.; DUNLOP, G.R.
ELECTRICAL ENGNG. DEPT., UNIV. OF CANTERBURY, CHRISTCHURCH,
NEW ZEALAND
OPT. COMMUN. (NETHERLANDS) VOL. 10, NO. 4 421-3 SEPT 1976
Coden: OPCDBB
Treatment: T

O2 THE BORN APPROXIMATION HAS BEEN SHOWN BY WOLF TO BE PARTICULARLY CONVENIENT FOR FORMULATING INVERSE SCATTERING PROBLEMS. THE RYTOV APPROXIMATION IS KNOWN TO BE MORE WIDELY APPLICABLE THAN THE BORN APPROXIMATION. AN IMPROVEMENT IS INTRODUCED THAT FURTHER INCREASES THE RANGE OF VALIDITY OF THE RYTOV APPROXIMATION. IT TRANSPIRES THAT THE EXTENSION OF THE RYTOV APPROXIMATION IS AS CONVENIENT FOR INVERSE SCATTERING AS THE BORN APPROXIMATION (9 Refs)

Descriptors: LIGHT SCATTERING; ELECTROMAGNETIC WAVE SCATTERING; REMOTE SENSING; EXTENDED RYTOV APPROXIMATION

PHYSICAL OPTICS FARFIELD INVERSE SCATTERING IN THE TIME DOMAIN

BLITSTEIN, N.
DEPT OF MATH., UNIV OF DENVER, DENVER, CO. USA
ACOUST SOC AM (USA) VOL 60, NO. 6 1249-95 DEC 1978
Coden: JASM
Treatment: T

O2 A PHYSICAL OPTICS FARFIELD INVERSE SCATTERING IDENTITY RELATING THE PHASE AND RANGE-NORMALISED BACKSCATTERING AMPLITUDE TO THE CHARACTERISTIC FUNCTION OF THE SCATTERER WHICH PRODUCED THE SIGNAL, WAS FIRST DERIVED BY BOJARSKI (1967) IN THE CASE OF IMPULSIVE POINT SOURCES. IN THE PRESENT PAPER IT, WHICH IS EXTENDED TO INCLUDE POINT SOURCES WITH A MORE GENERAL TEMPORAL DEPENDENCE AND ADVANTAGE IS TAKEN OF PREVIOUSLY UNOBSERVED SYMMETRIES TO SIMPLIFY THE SPATIAL INVERSION LEADING TO THE CHARACTERISTIC FUNCTION. AN ALTERNATIVE FORM OF BOJARSKI'S IDENTITY IS OBTAINED TOGETHER WITH AN IDENTITY IN THE TIME DOMAIN. THE IDENTITY IS TESTED USING ANALYTICALLY DERIVED BACKSCATTERED DATA FOR A SPHERE. THE DERIVATIVE OF THE CHARACTERISTIC FUNCTION IS CALCULATED, BEING NON-ZERO ONLY ON THE BOUNDARY OF THE SPHERE, THE ANGULAR INTEGRATION IS CARRIED OUT ANALYTICALLY AND THE INTEGRATION OVER FREQUENCY IS CARRIED OUT NUMERICALLY. BAND LIMITING IS CHECKED BY VARYING THE UPPER AND LOWER LIMITS IN THE LATTER CASE (9 Refs)

Descriptors: ACOUSTIC WAVE SCATTERING; TIME DOMAIN; PHYSICAL OPTICS; FARFIELD INVERSE SCATTERING; CHARACTERISTIC FUNCTION; POINT SOURCES; BOJARSKI'S IDENTITY

Section Class Codes: A4320
Inverse Source Problem: Eigenfunction Analysis of Bojarski's Integral Equation

Denver Research Inst Colo Div of Mathematical Sciences (405751)

Technical rept.
AUTHOR: Cohen, Jack K.; Bleistein, Norman
G6714J4 Fld: 12A, 46, 72B GRA17615
25 Apr 76 20p
Rept No: MS-R-7616
Contract: N00014-76-C-0079, N00014-76-C-0039
Project: NR-041-434, NR-083-364
Monitor: 18

Abstract: An integral equation elsewhere employed to solve inverse source problems is discussed from the viewpoint of Hilbert Space theory. The eigenfunctions and eigenvalues are determined and the null space is explicitly shown to be infinite dimensional. An existence criterion is established and application is made to the problem of determining sources which radiate maximum power for given input power. (Author)

Continuity of the Direct and Inverse Problems in One-Dimensional Scattering Theory and Numerical Solution of the Inverse Problem

Centro Brasileiro de Pesquisas Físicas, Rio de Janeiro. (1652000) AUTH: de Moura, C. A.
G126204 Fld: 20H, 46 GRA18015
Sep 76 60p
U.S. Sales Only.

Abstract: We propose an algorithm for computing the potential \( V(x) \) associated to the one-dimensional Schrödinger operator \( E \) identical to \(- d^2 / dx^2 + V(x)\), \(-\infty < x < \infty \) from knowledge of the \( S \) matrix. More exactly, of one of the reflection coefficients. The convergence of the algorithm is guaranteed by the stability results obtained for both the direct and inverse problems. (Atomindex citation 10:438587)

Identifiers: ERDA/645500, ERDA/657002, Brazil, NTISINIS, NTISFR

CBPF-A0026/76 NTIS Prices: PC A04/M W A01

1022482 A77019145. B77010130
ON AN EXTENDED RYTOV APPROXIMATION AND ITS COMPARISON WITH THE BORN APPROXIMATION

DUNLOP, G.R.; BOERNER, W.M.; BATES, R.H.T.
DEPT. OF ELECTRICAL ENG. UNIV. OF CANTERBURY, CHRISTCHURCH, NEW ZEALAND
IEEE, URSI
AP-S INTERNATIONAL SYMPOSIUM 1976 587-91 1976
11-15 OCT. 1976 AMHERST, MASS., USA
PUBL: IEEE NEW YORK, USA
IX+613
TREATMENT: AT
06

IN REMOTE SENSING PROBLEMS FOR CONTINUOUS INHOMOGENEOUS MEDIA, THE BORN APPROXIMATION IS USED CONVENIENTLY FOR TENUOUS, SLOWLY CHANGING MEDIA. THE RYTOV APPROXIMATION IS KNOWN, UNDER CERTAIN CIRCUMSTANCES, TO GIVE MORE ACCURATE RESULTS. THE AUTHORS HAVE INTRODUCED AN IMPROVEMENT THAT FURTHER INCREASES ITS RANGE OF VALIDITY. SOME NUMERICAL RESULTS ARE PRESENTED TO ILLUSTRATE ITS ADVANTAGES (10 Refs)

Descriptors: REMOTE SENSING; ELECTROMAGNETIC WAVE PROPAGATION
Identifiers: EXTENDED RYTOV APPROXIMATION; BORN APPROXIMATION; REMOTE SENSING; CONTINUOUS INHOMOGENEOUS MEDIA; VALIDITY; NUMERICAL RESULTS
Section Class Codes: A410H, B5210, B7730
962176 A7678097
INVERSE SCATTERING PROBLEMS IN ABSORBING MEDIA
Jaulent, M.
DEPT. OF PHYS. MATH., UNIV. DES SCI. TECH. DU LANGUEDOC.
MONTPELLIER, FRANCE
J. MATH. PHYS., NEW YORK (USA) VOL. 17, NO. 7 1351-60
JULY 1976 Coden: JMAPAQ
Treatment: T02
It is shown how to reduce inverse scattering problems occurring in various branches of physics to an inverse scattering problem for the radial S-wave Schrödinger equation with an energy-dependent potential. Various special cases are investigated (16 Refs)
Descriptors: SCHRODINGER EQUATION
Identifiers: ABSORBING MEDIA; INVERSE SCATTERING PROBLEMS;
RADIAL S-WAVE SCHRODINGER EQUATION; ENERGY DEPENDENT POTENTIAL
Section Class Codes: A1400
Unified Class Codes: DEAAKY

717811 10 NO. - EI770317811
3-D DISTRIBUTION OF SOURCES OF OPTICAL SCATTERING COMPUTED FROM COMPLEX-AMPLITUDE FAR-FIELD DATA.
Lee, D. K.; Schmidt-Weinmer, H. G.; Wouk, A.
Univ of Alberta, Edmonton
Can J Phys V 54 n 1976 p 1925-1936 CODEN: CUPHAD
A fast computer algorithm is presented to solve the scalar inverse scattering problem numerically by inverting a linear transformation which maps a 3-D distribution of scattering sources into the angular distribution of the resultant scattered far field. It is shown how an approximate solution to the problem can be found in discrete form which leads to non-singular systems of linear equations of a type whose matrix can be inverted readily by fast algorithms. The method uses Born's first approximation and is valid for a slowly varying refractive index: the resultant numerical problem can be solved by a fast algorithm which reduces computing time by about $10^{-7}$, storage requirement by about $10^{-5}$, as compared with Gaussian elimination applied to 125,000 sample points. With this algorithm, computerized 3-D reconstruction becomes feasible. 22 refs.
Descriptors: (+LIGHT. *Scattering).
CARD ALERT: 741

76101411
Formal solutions of inverse scattering problems. II
Prosser, Reese I.
Department of Mathematics, Dartmouth College, Hanover, New Hampshire 03755
J. Math Phys. (N.Y.) 17(10), 1775-1779 (OCT. 1976) CODEN: JMAPA
CPM: 7610-A-0061
WORK TYPE: THEORETICAL
PACS: *03.65.N
The formal solutions of inverse scattering problems presented in Paper I. J. Math. Phys. 10, 1819 (1969), are shown here to converge in certain cases of potential scattering for sufficiently weak potentials, and in certain cases of refractive scattering for sufficiently weak variations in the index of refraction. The solutions for the cases of boundary scattering, on the other hand, are not likely to converge, because there is no way to make the effect of the boundary sufficiently weak.

28
IDENTIFICATION OF BURIED DIELECTRIC ANOMALIES BY ALGEBRAIC PROCESSING OF MICROWAVE REFLECTIONS

Rope, E.L.; Hayward, R.A.; On-Ching Yue; Tricoles, G.
General Dynamics Electronics Div., San Diego, CA, USA

INTERNATIONAL OPTICAL COMPUTING CONFERENCE. (DIGEST OF PAPERS) 12-14 1976
31 AUG.-2 SEPT., 1976 CAPRI, ITALY

Publ: IEEE NEW YORK, USA
VIII 450

Treatment: A

05

The method can determine the depth and thickness of a buried layer, and can estimate lateral dimensions. The procedure is to measure the phase and intensity of the microwave field reflected in a monostatic arrangement in which an antenna both radiates and receives while scanning a linear path. An array of antennas could be scanned in the direction orthogonal to its length to eliminate repetitive scanning (6 Refs)

Descriptors: Geophysical Techniques; Microwave Measurement; Radar Applications; Scanning Antennas; Optical Information Processing; Electronics Applications of Computers

Identifiers: Buried Dielectric Anomalies; Algebraic Processing; Microwave Reflections; Depth; Thickness; Lateral Dimensions; Monostatic Arrangement; Scanning

Section Class Codes: B4800, B3640, C8842, B4425, C7425
Unified Class Codes: ZKVAAT, FGEAAL, WMEEAQ, BKCMAK

1053023 A77031048, B77021621

INVERSE SCATTERING METHODS
Uslenki, P.L.
Dept. of Information Engrg., Univ. of Illinois, Chicago, IL, USA

A Survey of Presently Available Methods in Inverse Scattering for Electromagnetic Fields, With a Selected Bibliography (17 Refs)

Descriptors: Electromagnetic Wave Scattering; Backscatter; Physical Optics

Identifiers: Inverse Scattering; Electromagnetic Fields; Bibliography; Back Scattering; Analytic Continuation; Vector Field; Wave Equation; Physical Optics; Inverse Boundary Conditions

Section Class Codes: A4110H, A4210H, B5210

095769 A78061231, B78035780

INVERSE SCATTERING AND TOMOGRAPHY
Bates, R.H.T.; Dunlop, G.R.
Electrical Engng. Dept., Univ. of Canterbury, Christchurch, New Zealand

Journal Ultrasonics
Ultrasonics International 1977 104-10 1977
28-30 June 1977 BRIGHTON, ENGLAND
Publ: IPC SCI. AND TECHNOL. PRESS GUILDFORD, ENGLAND
507 ISBN 0 902852 76 0

Treatment: APPLIC-REPORT SECTION-

An experimental apparatus is outlined. Images reconstructed from ultrasonic transmission measurements are presented. It is suggested how an extension of the Rytov-Approximation formulation of inverse scattering theory could be adapted to improve the quality of the reconstructed images (13 Refs)

Descriptors: Biomedical Ultrasonics; Ultrasonic Scattering; Acoustic Imaging

Identifiers: Ultrasonic Transmission Measurements; Inverse Scattering Theory; Image Reconstruction; Ultrasonic Imaging; Rytov Approximation
Abstract: This report deals with the electromagnetic response of inhomogeneous dielectrics, i.e., media whose permittivity is a function of depth. The resulting boundary value problem is solved for a large number of permittivity functions which can model almost any medium of interest. Since those permittivity profiles are characterized by only a few parameters, they are particularly useful for the inverse problem: i.e., the retrieval of profiles from the measured electromagnetic response. It is shown how the non-uniformity of the permittivity changes the response and how the change is related to the profile characteristics.

Descriptors: *Microwaves, *Remote sensing, Dielectric properties, Wave equations, Hypergeometric functions, Mathematical models, Boundary value problems

Identifiers: Inverse scattering, Inverse problems, NTISCON NBS

PB-263 124/OST NTIS Prices: PC AO2/MF AO1
A Note on the Inverse Source Problem

Denver Univ Colo Dept of Mathematics (406854)

Technical rept.
AUTHOR: Bleistein, Norman; Cohen, Jack K.
E142213 Fl: 20A, 12A, 46A G171815
15 Dec 77 8p
Rept No: MS-R-7807
Contract: N00014-76-C-0039
Monitor: 18

Abstract: In an earlier paper, the authors derived a Fredholm integral equation of the first kind for the solution of the inverse source problem for acoustic waves. The eigenvalues of this equation were shown to converge rapidly to zero and also to include zero. Thus, the solution was shown to be non-unique and even the particular part of the solution of that equation was ill-conditioned. In this note it is shown how to obtain the non-trivial information of that integral equation in a well-conditioned manner. (Author)


Identifiers: Fredholm equations, NTISDODXA

AD-A052 909/95T NTIS Prices: PC A02/MF A01

1036433 A77030015
NONUNIQUENESS IN THE INVERSE SOURCE PROBLEM IN ACOUSTICS AND ELECTROMAGNETICS
BLEISTEIN, N.; COHEN, J.K.
DEPT. OF MATH., UNIV. OF DENVER, DENVER, CO. USA
J. MATH. PHYS., NEW YORK (USA) VOL.18, NO.2 194-201
FEB. 1977 Coden: JMAPAQ
Treatment: T

02

THE INVERSE SOURCE PROBLEM FOR THE SCALAR WAVE EQUATION IS CONSIDERED. BY USING A FREDHOLM INTEGRAL EQUATION FORMULATION IT IS SHOWN THAT THE SOLUTION IS NOT UNIQUE: THIS NONUNIQUENESS IS RELATED TO FEATURES OF THE DIRECT RADIATION PROBLEMS (8 Refs)

Descriptors: ACOUSTIC WAVES; ELECTROMAGNETIC WAVES; WAVE EQUATIONS
Identifiers: ACOUSTICS; ELECTROMAGNETICS; INVERSE SOURCE PROBLEM; SCALAR WAVE EQUATION; FREDHOLM INTEGRAL EQUATION; DIRECT RADIATION PROBLEMS; WAVE EQUATIONS
Section Class Codes: A034OK, A4110H, A432O

041803 A78025953, B78015028
REFRACTIVE-INDEX PROFILE DETERMINATION OF OPTICAL FIBERS FROM THE DIFFRACTION PATTERN
BRINKMEYER, E.
UNIV. WUPPERTAL, WUPPERTAL, GERMANY
APPL. OPT. (USA) VOL.16, NO.11 2802-3 NOV. 1977
Coden: APOPAI
Treatment: THEORETICAL-EXPERIMENTAL-
JOURNAL PAPER-
SHOWS HOW THE REFRACTIVE INDEX PROFILE OF A FIBRE CAN BE OBTAINED AS A HANKEL TRANSFORM OF THE FAR-FIELD DIFFRACTION PATTERN (2 Refs)

Descriptors: OPTICAL FIBRES; REFRACTIVE INDEX MEASUREMENT; LIGHT DIFFRACTION
Identifiers: DIFFRACTION PATTERN; HANKEL TRANSFORM; REFRACTIVE INDEX PROFILE DETERMINATION; OPTICAL FIBRES
Section Class Codes: A4280M, A0760H, B413O, B7320P
SCATTERING OF RADIO WAVES BY A PLASMA CYLINDER.
Chumak, Yu. V.; Moisyak, R. I.
Kiev State Univ, Ukr SSR
Radiophys Quantum Electron v 20 n 1 Jan 1977 p 34-37
CODEN: RPQCAE
The scattering of radio waves by an infinite plasma cylinder in a vacuum with a Gaussian distribution of electrons along its radius is discussed. The problem is solved numerically by two methods: power series and the Runge-Kutta method. The inverse scattering coefficient and the phase of the reflected signal are found in the case of parallel and perpendicular polarization. It is shown that the polarization ratio does not exceed two. The problem is also solved for arbitrary polarization of the incident electromagnetic wave. 10 refs.
DESCRIPTORS: (+RADIO TRANSMISSION, +Scattering). (PLASMAS, Cylinders).

A Velocity Inversion Procedure for Acoustic Waves

Abstract: An approximate solution is presented to the seismic inverse problem for two dimensional velocity variations. The solution is given as a multiple integral over the data observed at the upper surface. An acoustic model is used and the reflections are assumed to be sufficiently weak to allow a linearization procedure in the otherwise non-linear inverse problem. Synthetic examples are presented demonstrating accuracy of the method with dipping planes at angles up to 45 deg and with velocity variations up to 20%. The method was also tested under automatic gain control, in which case velocity estimates were lost but the method nonetheless successfully migrated the data. (Author)

Descriptors: +Seismic waves, +Acoustic waves, Inverse scattering, Backscattering, Two dimensional, Variations, Velocity, Automatic gain control, Experimental data, Mathematical models

Identifiers: Inverse problems, NTISDDAXA

AD-A052 912/3ST NTIS Prices: PC AO3/MF AO1
A Generalization of the Direct and Inverse Problem for the Radial Schrödinger Equation

Lowell Univ Research Foundation MA (408596)

AUTHOR: Moses, Harry E. FID: 12A, 20J, 46, 72B GRAFT17910

2 May 77 22p

Grant: AFOSR-77-3169

Project: 2304

Task: A4


Abstract: No abstract available.


Identifiers: Inverse problems, NTIS DODXR

AD-A062 919/6ST NTIS Prices: PC A02/MF A01

A DISCRETE SAMPLING APPROACH TO THE INVERSE SCATTERING PROBLEM

JEDRZEJEWSKI, P.; KRITIKOS, H. NAVAL AIR DEV. CENTER, JOHNsville, PA, USA

IEEE, URSI

AP-S INTERNATIONAL SYMPOSIUM 1977 574-7 1977

20-22 JUNE 1977 STANFORD, CALIF., USA

PUBL: IEEE NEW YORK, USA

613

TREATMENT: T

06

ANALYTIC CONSIDERATIONS REQUIRE THAT THE SCATTERING DATA, IN THE FORM OF THE REFLECTION COEFFICIENT, BE KNOWN FOR ALL FREQUENCIES FROM -INFINITY TO +INFINITY. IN PRACTICE IT IS FEASIBLE TO TAKE ONLY A FINITE NUMBER OF FREQUENCY READINGS. AN APPROACH IS PRESENTED WHICH BRIDGES THE GAP BETWEEN THE ANALYTICAL AND THE PRACTICAL. TWO METHODS ARE APPLIED TO DATA RESULTING FROM THE FREQUENCY SAMPLING OF A HYPOTHETICAL THIRD ORDER BODY, THAT IS, A BODY WHOSE SCATTERING DATA RESULTS IN A THIRD ORDER RATIONAL REFLECTION COEFFICIENT. THE RESULTS ARE USED IN CONJUNCTION WITH THE GELFAND-LEVITAN EQUATION AND SOLVED BY KAY'S METHOD TO ARRIVE AT AN ESTIMATED EXPRESSION FOR THE POTENTIAL ARISING FROM THE CONSTRUCTED REFLECTION COEFFICIENTS TO THE ACTUAL POTENTIAL OF THE HYPOTHETICAL THIRD ORDER BODY (4 Refs)

Descriptors: ELECTROMAGNETIC WAVE SCATTERING

Identifiers: DISCRETE SAMPLING APPROACH; INVERSE SCATTERING PROBLEM; SCATTERING DATA; REFLECTION COEFFICIENT; FREQUENCY SAMPLING; GELFAND LEVITAN EQUATION; KAY'S METHOD

Section Class Codes: A4110H. B5210

Fast Algorithms for the Integral Equations of the Inverse Scattering Problem

Stanford Univ CA Dept of Electrical Engineering (400852)

AUTHOR: Anderson, B. D. O.; Kailath, Thomas

FID: 12A, 72B GRAFT17910

1978 6p

Contract: F44620-74-C-0068, DAAG29-77-C-0042

Project: 2304

Task: A6

Monitor: AFOSR-TR-78-1562


Abstract: No abstract available.

Descriptors: *Inverse scattering, *Integral equations, Algorithms, Operators (Mathematics), Reprints

Identifiers: NTIS DODXR

AD-A062 898/2ST NTIS Prices: PC A02/MF A01
A Wave Equation for Radiating Source Distributions

Bojarski (Norbert N) Newport Beach Ca (389425)

Scientific rept.
AUTHOR: Bojarski, Norbert N.
E1294H2 Fl: 20C. 46 GRA17814
Feb 78 13p
Contract: NO0014-76-C-0082
Monitor: 18

Abstract: The Blelstein Cohen separation of a source (for the inhomogeneous Helmholtz wave equation) distribution into radiating and non-radiating portions is reformulated into a form suitable for deriving a wave equation governing the radiating portion of the source distribution. (Author)

Descriptors: *Inverse scattering, Sources, Distribution functions, Wave equations, Radiation, Separation, Maxwells equations, Bessel functions

Identifiers: *Helmholtz equation, NTIS000X4

AD/A052 590/7ST NTIS Prices: PC A02/MF A01

102826 A78065820
NONUNIQUENESS IN THE INVERSE SCATTERING PROBLEM
DEVANEY, A.J.
EIKONIX CORP., BURLINGTON, MA, USA
J. MATH. PHYS. (USA) VOL. 19. NO. 7 1526-31 JULY 1978
Coden: JMAPAO

Treatment: THEORETICAL-
JOURNAL PAPER-


Descriptors: POTENTIAL SCATTERING; QUANTUM THEORY
Identifiers: INVERSE SCATTERING PROBLEM; FIRST BORN APPROXIMATION; EXACT (POTENTIAL) SCATTERING THEORY; EXACT SCATTERING THEORY

Section Class Codes: A0380, A0365N
INFRARED REMOTE TEMPERATURE MEASUREMENTS: ITS PHYSICS WITH REFERENCE TO COMPLEXITIES, APPROXIMATIONS AND LIMITATIONS INVOLVED. II. TEMPERATURE PROFILE RETRIEVAL

Gupta, R. K.
Indian Inst. of Tropical Meteorology, Pune, India


Coden: JIISAD

Treatment: THEORETICAL-
JOURNAL PAPER-


Descriptors: TEMPERATURE MEASUREMENT: TEMPERATURE DISTRIBUTION: REMOTE SENSING: ATMOSPHERIC TEMPERATURE

Section Class Codes: A9385, A92650, A9260

Inverse scattering theory is concerned with the mathematical description of an unknown region from the knowledge of the scattering data, for instance the incident and scattered electromagnetic waves. If the unknown region is an inhomogeneous medium whose refractive index varies in one spatial dimension, then the inverse scattering problem can be called profile reconstruction. A reconstruction method that provides closed-form expressions for the profiles of electron density from the analytic representation of the reflection coefficient is demonstrated. 14 refs.

Descriptors: (*ELECTROMAGNETIC WAVES, *Scattering),
Identifiers: QUANTUM SCATTERING
CARD ALERT: 711
TEMPERATURE HEIGHT PROFILE DETERMINATION BY AIRCRAFT MEASUREMENTS OF THE OUTGOING RADIO EMISSION OF THE EARTH-ATMOSPHERE SYSTEM

KITA!, SH.O.; SUMIN, M.I.; TROITSKII, A.V.
12V. AKAD. NAUK SSSR FIZ. ATMOS. AND OKEANA VOL. 14, NO. 11
1131-8 NOV. 1978 Coden: IFAOAV
Trans In: IZV. ACAD. SCI. USSR ATMOS. AND OCEANIC PHYS. (USA) Coden: BSUAZ
Treatment: THEORETICAL-JOURNAL PAPER-
Languages: RUSSIAN


Descriptors: ATMOSPHERIC TEMPERATURE; REMOTE SENSING; ATMOSPHERIC RADIATION
Identifiers: AIRCRAFT MEASUREMENTS; OUTGOING RADIO EMISSION; REMOTE SENSING; TEMPERATURE HEIGHT PROFILES; ANGLE RADIOMETRIC MEASUREMENTS; EARTH ATMOSPHERE SYSTEM; MM 0005; 5 MM WAVELENGTH; EMF

AN INVERSE PROBLEM FOR AN ABSORBING MEDIUM WITH MULTIPLE DISCONTINUITIES

KRUEGER, R.J.
UNIV. OF NEBRASKA, LINCOLN, NE, USA
O. APPL. MATH. (USA) VOL. 36, NO. 3 235-53 OCT. 1978
Cod: OAMAAY
Treatment: THEORETICAL-JOURNAL PAPER-

DEALS WITH AN INVERSE PROBLEM FOR WAVE PROPAGATION IN AN ABSORBING MEDIUM. THE MOTIVATION FOR THE WORK CAME FROM A ONE-DIMENSIONAL ELECTROMAGNETIC INVERSE SCATTERING PROBLEM IN WHICH THE CONDUCTIVITY SIGMA(Z) AND PERMITTIVITY EPSILON(Z) OF A SLAB OF FINITE THICKNESS SITUATED BETWEEN Z=0 AND Z=L WERE OBTAINED BY WORKING IN THE SPACE-TIME DOMAIN. EPSILON AND SIGMA ARE ALLOWED TO HAVE ANY FINITE NUMBER OF JUMP DISCONTINUITIES IN 0<Z<L, AS WELL AS BEING DISCONTINUOUS AT Z=0 AND Z=L. IT IS SHOWN THAT THE DATA FOR THE SOLUTION CAN BE OBTAINED FROM FINITE PORTIONS OF A SINGLE INCIDENT, REFLECTED AND TRANSMITTED WAVE. THE RECONSTRUCTION OF EPSILON AND SIGMA CAN THEN BE ACHIEVED BY SOLVING A LINEAR INTEGRAL EQUATION CONTAINING ADVANCE AND DELAY TERMS (10 Refs)

Descriptors: ELECTROMAGNETIC WAVE PROPAGATION
Identifiers: INVERSE PROBLEM; ABSORBING MEDIUM; MULTIPLE DISCONTINUITIES; WAVE PROPAGATION

Section Class Codes: A410M, A0340K
A general method is proposed of the acoustical investigation of stratified media, showing either continuous or discontinuous profile: acoustic impedography. Neglecting the phenomena of absorption and dispersion, the Pekeris equation is used to describe the acoustical propagation with its transformation into the Schrodinger one to solve the inverse scattering problem of quantum mechanics. In order to use the preceding algorithms to determine the impulse response, the application of the algorithm of Gelfand-Levitan (or of Jost-Kohn if one prefers to work with frequency response) to give the scattering potential, and then the calculus of the acoustic impedance profile is obtained from the scattering potential.

It is shown that the first iterate gives the same expression as that actually used by Jones in his "Ultrasonic Impedigraphy" for the identification of biological tissue and also by Wright in his "Acousticore" derived for the surveying of sea-beds. Higher order iterations will automatically take into account multiple reflections occurring in all large impedance gradients, thus insuring the validity of the method for all complex configurations. Hence the method is applicable to all one dimensional acoustical investigations as varied as non-destructive testing, seismic, oceanographic or atmospheric prospecting and medical echography, and the convergence is very superior to that of the general optimal control procedure in seismology.

31 refs.
EXAMINATION OF THE LIMITED APERTURE PROBLEM OF PHYSICAL OPTICS INVERSE SCATTERING.

Mager, Robert D.; Bleistein, Norman
Colo Sch of Mines, Golden
CODEN: IETPAK

The limited aperture problem of physical optics inverse scattering is examined via the method of multidimensional stationary phase. It is shown that target information is recoverable from band-limited and aspect-limited scattering data. Examples are presented for the case of a perfectly reflecting circular cylinder. 7 refs.

DESCRIPTORS: *ANTENNAS. CYLINDRICAL.
CARD ALERT: 716
We consider the inverse scattering problem for the one-dimensional Schrödinger equation on the whole line.

\[
\frac{d^2}{dx^2} \phi(x) + \lambda \phi(x) - V(x) \phi(x) = 0.
\]

In some applications, as for example in the synthesis of electromagnetic media, it is important to have sufficient conditions on the scattering data such that the corresponding potential has compact support in some prescribed interval. The scattering data traditionally used in connection with the above ISP have been either one of the reflection coefficients (we are assuming that the potential \(V\) does not support bound states) \(r\) and \(r'\) from the left and right, respectively. Although it is easy to obtain simple conditions on \(r\) or \(r'\) to ensure cutoff of the potential on the left (right), conditions on \(r\) or \(r'\) that guarantee cutoff on the right (left) are too complicated to be of any practical value. In this paper, we propose to use new scattering data, namely the ratio \(r/t\) (where \(r\) is either one of the reflection coefficients and \(t\) is the transmission coefficient), and give necessary and sufficient conditions for the corresponding potential to have support contained in \([-a, a]\).
DETERMINATION OF THE INDEX PROFILE OF A DIELECTRIC PLATE BY OPTICAL METHODS
ROGER, A.; MAYSTRE, D.
FACULTE DES SCI. ET TECH., CENTRE DE SAINT-JEROME, MARSEILLE, FRANCE
SOC. PHOTO-OPTICAL INSTRUMENTATION ENGR(S).
BELLINGHAM, WA., USA
VIII+376 ISBN 0 89252 163 5
Treatment: THEORETICAL-
REPORT SECTION-
DEALS WITH AN INVERSE SCATTERING PROBLEM AND SHOWS THAT IT IS POSSIBLE, FOR INSTANCE, TO DEDUCE THE INDEX PROFILE OF AN INHOMOGENEOUS PLATE FROM ITS REFLECTION COEFFICIENT (2 Refs)
Descriptors: LIGHT SCATTERING: REFRACTIVE INDEX: LIGHT REFLECTION
Identifiers: DIELECTRIC PLATE: INVERSE SCATTERING: INHOMOGENEOUS PLATE: REFLECTION COEFFICIENT: REFRACTIVE INDEX PROFILE
Section Class Codes: A4220, A0760H

Spectral and Scattering Inverse Problems
Montpellier-I Univ. (France). Lab. de Physique Mathematique.
AUTHOR: Sabatier, P. C.
F1762H3 Fld: 12A, BK, 72B, 48F STAR1715
Apr 78 56p
Rept No: PM/78/4
Monitor: 18

Abstract: The reconstruction of a differential operator from discrete spectra is reduced to its reconstruction from an S-matrix. This method makes it possible to solve the singular Sturm-Liouville problems which determine certain modes of a sphere. Results show that information on modes and scattering can be taken into account together. They are applied to the earth inverse problem and partial answers are given to a well-known conjecture. Finally, the relevance of the WKB approximation to this kind of problem is succinctly discussed.


N79-24244/25T NTIS Prices: PC A03/MF A01

RAY LAUNCHING AND OBSERVATION IN GRADED-INDEX OPTICAL FIBERS.
Bellare, Kevin F.; Pask, Colin
Aust Ntl Univ. Canberra
J Opt Soc Am v 69 n 2 Feb 1979 p 294-300 CODEN: JOSAH
ISSN 0030-3941
General mathematical and numerical results are given for graded-index optical fibers excited by parallel beams. The excitation of bound and tunneling rays and their influence on power transmission and impulse response are described. The relevance of the results to other problems such as fiber excitation by partially coherent sources and the appearance of fiber output facets is discussed. The graded-index fiber equivalent of the black-band phenomena in step-index fibers is described and an application to profile determination is considered.
Descriptors: *FIBER OPTICS,
Two methods of solving the inverse problem for elastic waves at normal incidence on horizontally stratified media are discussed: Goupillaud's equal-travel-time-layer approach, and Ware and Aki's inverse-scattering method. The scattering method is simplified by showing that the impedance is proportional to the square of the Jost solution at zero frequency. The scattering method is discretized and a recursion relation is found for the impedance. In the continuum limit, the two methods are equivalent where the impedance is continuous but nonequivalent at points of discontinuity. The scattering method assigns the arithmetic average across the jump to the jump point.

**Identifiers:** Elasticity; Sound Waves; Stratification; Layers; Mathematical Models; Scattering; Impedance; Frequency Dependence; Recursion Relations; Comparative Evaluations

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**Descriptors:** Physics; Computing; Evaluation; Crack Detection; Fourier Analysis; Acoustic Wave Scattering

**Section Class Codes:** A4320, A0230, A8170, C7320
321464 B80006326 DEVELOPMENT OF PHYSICAL OPTICS FAR FIELD INVERSE SCATTERING (POFFIS) AND ITS LIMITATIONS (RADAR IMAGING)
BOERNER, W.M.; CHIK-MIN HO
DEPT. OF ELECTRICAL ENGNG., UNIV. OF MANITOBA, WINNIPEG, CANADA
IEEE 1979 INTERNATIONAL SYMPOSIUM DIGEST. ANTENNAS AND PROPAGATION 240-3 1979 18-22 JUNE 1979 SEATTLE, WA, USA Publ: IEEE NEW YORK, USA 37+390
Treatment: THEORETICAL-
REPORT SECTION-
THE HISTORICAL DEVELOPMENT OF VARIOUS EXISTING POFFIS IDENTITIES IS SUMMARIZED, AND THE APPARENT INCOMPLETENESSES OF THESE TECHNIQUES IS IDENTIFIED (21 Refs)
Descriptors: RADAR THEORY; PHYSICAL OPTICS; LIGHT SCATTERING
IDENTIFIERS: PHYSICAL OPTICS FAR FIELD INVERSE SCATTERING; RADAR IMAGING; POFFIS; LIGHT SCATTERING
Section Class Codes: B6310, B5210E

320850 A80009784, B80005509 N-DIMENSIONAL FAST FOURIER TRANSFORM TOMOGRAPHY FOR INCOMPLETE INFORMATION, AND ITS APPLICATION TO ELECTROMAGNETIC INVERSE SCATTERING THEORY
BOJARSKI, N.N. IEEE 1979 INTERNATIONAL SYMPOSIUM DIGEST. ANTENNAS AND PROPAGATION 246 1979 18-22 JUNE 1979 SEATTLE, WA, USA Publ: IEEE NEW YORK, USA 37+390
Treatment: THEORETICAL-
REPORT SECTION-
SUMMARY FORM ONLY GIVEN
Descriptors: ELECTROMAGNETIC WAVE SCATTERING; FOURIER TRANSFORM OPTICS
Identifiers: ELECTROMAGNETIC INVERSE SCATTERING THEORY; N DIMENSIONAL FFT TOMOGRAPHY; FAST FOURIER TRANSFORMS
Section Class Codes: A4110H, A4230K, B5210E

80010537 On three-dimensional inversion of P wave time residuals:
Option for geological modeling
Christoffersson, A.; Husebye, E. S., Department of Statistics, University of Uppsala, Uppsala, Sweden; NTNF/Norsar, Kjeller, Norway
J. Geophys. Res.84(B10),6168-6176 (10 OCT. 1979) CODEN: JGREA

UGCBEA WORK TYPE: THEORETICAL PACS: +91.35.E. 91.35.G
In this paper some simple algorithms are introduced which give added flexibility to the Aki et al. (1977) inversion technique of two-dimensional travel time data. The new options include, besides computational efficiency, a block equalization scheme which may be used for smoothing poorly sampled blocks, testing whether geological surface contours have a counterpart in the deeper lithosphere and also to restrict the anomalous volume to parts of the lithosphere only. This novel computational scheme is demonstrated on a large Norsar data set, and the main results were as follows. Even a single heterogeneous layer at a depth of round 170 km, i.e., a two-dimensional model, gives a not unreasonable fit to the observational data (explained variance of the order of 60 per cent). Six prominent surface geological features have no counterparts in the deeper lithosphere, though a seismic counterpart of the Oslo graben (associated with a marked gravity high) is found in the crustal layer. Changes in the basic model parameters like number and thickness of layers affect only the secondary features of the final three-dimensional seismic image of parts of the lithosphere. Physical smoothing of the final results in terms of equalizing poorly sampling blocks (e.g., number of hits less than 8) to nearby ones is demonstrated to be a viable alternative to introducing specific smoothing kernels.
IDENTIFIERS: SEISMIC P WAVES; EARTH CRUST; EARTH MANTLE; WAVE PROPAGATION; INVERSE SCATTERING PROBLEM; THREE-DIMENSIONAL CALCULATION; COMPUTER CALCULATIONS
1011664 ID NO.: E1800211664
SINGULAR FUNCTION OF A SURFACE AND PHYSICAL OPTICS INVERSE SCATTERING.
Cohen, Jack K.; Blelstain, Norman
Univ of Denver, Colo
Wave Motion v 1 n 3 Jul 1979 p 153-161 CODEN: WAMDD9
It is shown how to recover both the location and the reflection coefficient of a scatterer using only high frequency backscattered data. The result is obtained without use of the far field approximation although a separate identity is derived when this approximation is introduced. This latter result improves upon previously derived physical optics far field inverse scattering identities. 15 refs.
DESCRIPTORS: (+ELECTROMAGNETIC WAVES. +Scattering).
CARD ALERT: 711

1036778 ID NO.: E1800536778
COMPARISON BETWEEN VARIOUS FIBRE CHARACTERIZATION TECHNIQUES.
Costa, Bruno
Cent Studi e Lab Telecomun, Torino, Italy
CSELT Rapp Tec v 7 n 4 Dec 1979 p 255-260 CODEN: CSELBY
The main characterization methods for optical fibers are examined, with a discussion on their relative advantages and disadvantages. In particular some recent results regarding the interpretation of back-scattering data are presented, as well as an evaluation of the applicability of the same method for splice loss measurement. The differential mode delay measurement technique and the reflectometric method for refractive index profile determination are also discussed. 20 refs.
DESCRIPTORS: +FIBER OPTICS. WAVEGUIDES. OPTICAL.
CARD ALERT: 741, 711, 714

803891 ORDER NO.: A0D80-10358
CONSTRUCTIVE SOLUTION AND CHARACTERIZATION OF THE INVERSE SCATTERING PROBLEM FOR THE ONE-DIMENSIONAL ACOUSTIC WAVE EQUATION 120 PAGES.
GREENE, ROBERT REX (PH.D. 1979 NEW YORK UNIVERSITY).
PAGE 5297 IN VOLUME 40/11-B OF DISSERTATION ABSTRACTS INTERNATIONAL.
MATHEMATICS.
DESCRIPTOR CODES: 0405
INSTITUTION CODE: 0146

302624 A79097214
THE INVERSE PROBLEM FOR RANDOM SOURCES
DEVANEY, A.J.
SCHLUMBERGER-DOLL RES. CENTER, RIDGEFIELD, CT, USA
J. MATH. PHYS. (USA) VOL.20, NO.8 1687-91 AUG. 1979
Coden: JMAPAQ
Treat.: THEORETICAL-JOURNAL PAPER.
The problem of deducing the statistical structure of a localized random source $\rho(R)$ of the reduced wave equation from measurements of the field external to the source is addressed for the case when the measurements yield the autocorrelation function of the field at all pairs of points exterior to the source volume and the quantity to be determined is the source's autocorrelation function $R/Sub Rho(R/Sub 1/R/Sub 2)$. This problem is shown to be equivalent to that of determining $R/Sub Rho(R/Sub 1/R/Sub 2)$. The solution is unique and found, in general, not to admit a unique solution due to the possible existence of nonradiating sources within the source volume. Notable exceptions are the class of delta correlated (incoherent) sources whose intensity profiles are shown to be uniquely determined from the data and the class of quasihomogeneous sources whose coherence properties can be determined if their intensity profiles are known and vice versa (17 Refs).
DESCRIPTORS: RANDOM PROCESSES; WAVE EQUATIONS; STATISTICAL MECHANICS.
Identifiers: INVERSE PROBLEM; RANDOM SOURCES; STATISTICAL STRUCTURE; REDUCED WAVE EQUATION; AUTOCORRELATION FUNCTION; QUASIHOMOGENEOUS SOURCES; DELTA CORRELATED SOURCES.
Problems by Mesh Adapting


AUTHOR: Hagin, F.
F1943K3 Fld: 12A, 72B GRA17922

Contract: EY-76-C-02-2482
Monitor: 18

Abstract: The numerical solution of linear Fredholm I integral equations of the type arising from various one-dimensional inverse scattering problems is addressed. Typically, when these equations are discretized, they lead to very ill-conditioned algebraic systems. It is shown that for these types of kernels a relatively simple mesh adapting scheme leads to very well-conditioned systems. Moreover, when the kernel is not known explicitly but must be generated by numerically solving a boundary-value problem, it is shown that an asymptotic analysis can extract the information to adapt this mesh successfully. 4 figures, 4 tables. (ERA citation 04:042136)

Descriptors: Fredholm equation, Boundary-value problems, Coordinates, Numerical solution, One-dimensional calculations, Scattering

Identifiers: ERDA/990200, Integral equations, Inverse scattering, Numerical integration, NTISDE

CODA-2482-10 NTIS Prices: PC A03/MF A01

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THE SCALAR THEORY OF NONRADIATING PARTIALLY COHERENT SOURCES

HOENDERS, B.J.; BALTES, H.P.
ZENTRALE FORSCHUNG UND ENTWICKLUNG, LANDIS AND GYR ZUG AG.
ZUG, SWITZERLAND

LETT. NUOVO CIMENTO (ITALY) VOL 25, SER.2, NO.7 206-8
16 JUNE 1979 Coden: LNUCAE

Treatment: THEORETICAL-JOURNAL PAPER-

THE EXISTENCE OF NONRADIATING SOURCES IS CRUCIAL FOR THE UNIQUENESS OF RELATED INVERSE SOURCE PROBLEMS. SOURCES CAN BE DETERMINED FROM THE EMITTED RADIATION ONLY UP TO THEIR NONRADIATING PART. WHILE SUFFICIENT AND NECESSARY CONDITIONS ARE KNOWN FOR NONRADIATING DETERMINISTIC SOURCES, THE CORRESPONDING PROBLEM FOR THE STOCHASTIC SOURCES AND FIELDS OF ARBITRARY DEGREE OF COHERENCE HAS NOT BEEN STUDIED HITHERTO. THE AUTHORS PRESENT A SIMPLE FOURIER TRANSFORM CRITERION WHICH ALLOWS THEM TO CHECK WHETHER GIVEN SOURCE CORRELATIONS ARE NONRADIATING. HOWEVER THEY DEVISE A GENERAL PROCEDURE THAT ALLOWS THE CONSTRUCTION OF SUCH CORRELATIONS. THE KNOWN DETERMINISTIC RESULTS ARE REPRODUCED IN THE COHERENT LIMIT (I.E. FACTORIZING CORRELATIONS) (5 Refs)

Descriptors: QUANTUM OPTICS; FOURIER TRANSFORM OPTICS

Identifiers: SCALAR THEORY; NONRADIATING PARTIALLY COHERENT SOURCES; FOURIER TRANSFORM CRITERION

Section Class Codes: A4250, A4230K
INVERSE SCATTERING THEORY AND PROFILE RECONSTRUCTION
JORDAN, A.K.; AHN, S.
NAVAL RES. LAB., WASHINGTON, DC, USA
PROC. INST. ELECTR. ENG. (GB) VOL. 126, NO. 10 945-50 OCT. 1979 Coden: PIEEEAH

Treatment: THEORETICAL-
JOURNAL PAPER-
PRESENTS AN ANALYTIC METHOD FOR THE RECONSTRUCTION OF THE PROFILES OF REFRACTIVE INDEXES OF INHOMOGENEOUS STRATIFIED REGIONS. THE REFLECTION COEFFICIENT R(KAPPA) FOR TIME-HARMONIC ELECTROMAGNETIC WAVES IS REPRESENTED AS A RATIONAL FUNCTION OF KAPPA. THE WAVE NUMBER. 1-DIMENSIONAL INVERSE SCATTERING THEORY HAS BEEN APPLIED TO OBTAIN ANALYTIC, CLOSED-FORM EXPRESSIONS FOR THE PROFILE FUNCTIONS Q(X) FROM R(KAPPA). THE PROFILE RECONSTRUCTION METHOD IS DEMONSTRATED WITH A 3-POLE R(KAPPA). THAT RESULTS IN A Q(X) WHICH RESEMBLES AN IONOSPHERIC ELECTRON-DENSITY PROFILE PREVIOUSLY ANALYSED BY DIRECT SCATTERING METHODS. THE PRESENT COMMUNICATION GENERALISES PREVIOUS RESULTS TO OBLIQUE INCIDENCE AND COMPARES SEVERAL Q(X) OBTAINED FROM DIFFERENT RATIONAL APPROXIMATIONS TO R(KAPPA). (17 Refs)

Descriptors: ELECTROMAGNETIC WAVE SCATTERING; REFRACTIVE INDEX; IONOSPHERIC ELECTROMAGNETIC WAVE PROPAGATION; RADIOWAVE PROPAGATION
Identifiers: PROFILE RECONSTRUCTION; ANALYTIC METHOD; REFRACTIVE INDEXES; REFLECTION COEFFICIENT; INVERSE SCATTERING THEORY; PROFILE FUNCTIONS; INVERSE SCATTERING THEORY; REFRACTIVE INDEXES; ELECTROMAGNETIC WAVE SCATTERING

Section Class Codes: A4iOH, A4220G, B5210H, B5210C

A REVIEW OF THE ONE DIMENSIONAL INVERSE SCATTERING PROBLEM FOR STRATIFIED INHOMOGENEOUS MEDIA
KAY, I.W.
IEEE 1979 INTERNATIONAL SYMPOSIUM DIGEST. ANTENNAS AND PROPAGATION 221-4 1979
18-22 JUNE 1979 SEATTLE, WA, USA
Publ: IEEE NEW YORK, USA 37+390

Treatment: GENERAL, REVIEW-THEORETICAL-
REPORT SECTION-
THE ONE-DIMENSIONAL INVERSE SCATTERING PROBLEM ARISES IN DETERMINING THE FREE ELECTRON DENSITY OF THE IONOSPHERE FROM VERTICAL RADIO SOUNDING DATA. THIS DATA IS USUALLY PRESENTED IN THE FORM OF A CURVE, REFERRED TO AS AN IONOGRAM, THAT GIVES THE VIRTUAL REFLECTION HEIGHT OF A NARROW PULSE AS A FUNCTION OF ITS CARRIER FREQUENCY (14 Refs)

Descriptors: IONOSPHERIC ELECTROMAGNETIC WAVE PROPAGATION; ELECTROMAGNETIC WAVE SCATTERING; REVIEWS
Identifiers: ONE DIMENSIONAL INVERSE SCATTERING PROBLEM;
Inversion of One-Dimensional Scattering Data Using Prony's Method

California Univ., Livermore, Lawrence Livermore Lab., Department of Energy. (R500007)

AUTHOR: Miller, E. K.; Lager, D. L.

FID: 20N, 48 GRA17921

12 Feb 79 15p

Contract: W-7405-ENG-48

Monitor: 18

Abstract: A one-dimensional configuration is the simplest geometry to invert, yet it has practical application to such problems as scattering from inhomogeneous half-spaces and propagation on nonuniform transmission lines. Whether the medium parameters vary continuously or discretely with position, the problem's numerical description can usually be developed in finite-difference approximation. As such, the scattered and transmitted fields can be represented as exponential series, whose exponents are related to the electrical thicknesses of the layers which make up the model. If the exponents or poles are derivable from field data, then the inverse problem is formally solvable. This report considers application of Prony's method, a procedure for obtaining the poles of exponential signals, to such one-dimensional problems. Both time-domain and frequency-domain data are analyzed. The effects of the medium characteristics, number of layers, and other factors are examined. It is concluded that Prony's method has merit for certain classes of one-dimensional inverse problems. 8 figures, 1 table. (ERA citation 04:099962)

Electromagnetic radiation, Dielectric materials, Finite difference method, Graphs, Layers, One-dimensional calculations, Reflection, Scattering, Series expansion, Singularity, Theoretical data, Transmission, Wave propagation


UCRL-52667 NTIS Prices: PC A02/MF A01

799541 ORDER NO. AAD60-06921

ACOUSTIC INVERSE SCATTERING AS A MEANS FOR DETERMINING THE AREA FUNCTION OF A LOSSY VOCAL TRACT: THEORETICAL AND EXPERIMENTAL MODEL STUDIES 348 PAGES.

RESNICK, JEFFREY RICHARD (PH.D. 1980 THE JOHNS HOPKINS UNIVERSITY).

PAGE 4336 IN VOLUME 40/09-B OF DISSERTATION ABSTRACTS INTERNATIONAL.

PHYSICS, ACOUSTICS

DESCRIPTOR CODES: 0986

INSTITUTION CODE: 0098

320848 ABO009502, 880006507

THE INVERSE SOURCE PROBLEM IN LIGHT SCATTERING

ROSS, G.; MOZZI, H.; FIDDY, W.A.; NIEVO-VESPERINAS, M.

PHYS. DEPT., QUEEN ELIZABETH COLL., UNIV. OF LONDON, LONDON, ENGLAND

IEEE

1979 INTERNATIONAL SYMPOSIUM DIGEST. ANTENNAS AND PROPAGATION 332-9 1979 18-22 JUNE 1979 SEATTLE, WA, USA

PUB1: IEEE NEW YORK, USA 374390

TREATMENT: THEORETICAL- REPORT SECTION

THE FUNDAMENTAL DIFFICULTY IN OBTAINING INFORMATION ABOUT A MEDIUM, THROUGH WHICH AN ELECTROMAGNETIC WAVE IS PROPAGATING,
Numerical Stability in an Inverse Scattering Problem

Wisconsin Univ-Madison Mathematics Research Center (221200)

Technical summary rept.
AUTHOR: Symes, W. W.
G034313 Fld: 12A, 72B, 46 GRA18005
Aug 79 49p
Rept No: MRC-TSR-1990
Contract: DAA029-75-C-0024
Grant: NSF-MCS78-09525
Monitor: 18

Abstract: The main result of this paper is a stability theorem for a certain class of difference algorithms designed to give approximate solutions of a model inverse scattering problem in one dimension. This stability result guarantees the convergence of the approximate solutions to the exact solution of the problem as the grid of the difference scheme is refined. The results of numerical experiments are presented based on one of these schemes, in which second-order convergence is observed. Furthermore the cost (that is, the dependence on N of the number of arithmetic operations required to compute the solution at N grid points) of the algorithms discussed below is essentially optimal.

Descriptors: *Inverse scattering, *Numerical methods and procedures, Difference equations, Stability, Convergence, Solutions(General), Algorithms, Volterra equations, Optimization

Identifiers: NTISDDOA, NTISNSFG

AD-A077 135/2 NTIS Prices: PC A03/MF A01
NONLINEAR APPROACH TO INVERSE SCATTERING

WESTON, V. H.
DIV. OF MATH. SCI., PURDUE UNIV., WEST LAFAYETTE, IN, USA

J. MATH. PHYS. (USA) VOL. 20, NO. 1 53-9 JAN. 1979

Treatment: THEORETICAL.
JOURNAL PAPER

THE INVERSE SCATTERING PROBLEM FOR THE SCALAR WAVE EQUATION ASSOCIATED WITH PROPAGATION THROUGH A MEDIUM WHOSE INDEX OF REFRACTION DIFFERS FROM THAT OF FREE SPACE IN A REGION OF COMPACT SUPPORT IS TREATED WHEN THE SCATTERED DATA IS GIVEN FOR DIVERSE DIRECTIONS OF (PLANE WAVE) INCIDENCE, SCATTERED DIRECTIONS, AND FREQUENCIES. THE PROBLEM IS FORMULATED IN TERMS OF THE MINIMIZATION OF A NONLINEAR FUNCTIONAL WHICH IS BOUNDED BELOW, SUBJECT TO CONSTRAINTS. IT IS SHOWN THAT THE CONDITIONAL-GRADEINT METHOD MAY BE EMPLOYED, THE ITERATION PROCESS CONVERGING TO STATIONARY POINTS. THE LINEARIZED VERSION (CORRESPONDING TO THE PERTURBED WAVE EQUATION WITH ONLY THE LINEAR PERTURBED TERMS RETAINED) OF THE NONLINEAR FUNCTIONAL IS CONSIDERED AS A SPECIAL CASE. IN PARTICULAR THE LINEARIZED VERSION RELATED TO THE BORN APPROXIMATION LEADS TO SOME ADDITIONAL NEW RESULTS (11 Refs).

Descriptors: POTENTIAL SCATTERING; ITERATIVE METHODS.
Identifiers: INVERSE SCATTERING; SCALAR WAVE EQUATION; INDEX OF REFRACTION; COMPACT SUPPORT; SCATTERED DIRECTIONS; FREQUENCIES; MINIMIZATION; NONLINEAR FUNCTIONAL; CONSTRAINTS; ITERATION PROCESS; STATIONARY POINTS; LINEARIZED VERSION; BORN APPROXIMATION; DIVERSE DIRECTIONS OF INCIDENCE; CONDITIONAL GRADIENT METHOD.

Section Class Codes: A0365N, A0380

1062958 ID NO.: E1800862958
DISCRETE INVERSE METHODS FOR ELASTIC WAVES IN LAYERED MEDIA.
Berryman, James G.; Greene, Robert R.
Courant Inst of Math Sci., New York, NY
Geophysics v 45 n 2 Feb 1980 p 213-233 CODEN: GPYSA7
ISSN 0016-8033
The seismic inverse problem for waves at normal incidence on horizontally layered media is discussed. The emphasis is theoretical rather than practical, but some long-standing questions concerning the general applicability of the often taught Goupillaud inverse method are answered. In all, three

102769 ID NO.: E171X002769
Density profile determination in a laser created plasma by an holographic method
BORIN JL; BUGES JC; ROUZAUD P; TERNEAUD A
Commissariat a l'Energie Atomique, Villeneuve-Saint-Georges, France
DESCRIPTORS: (+PLASMAS, +Laser Generated, HOLOGRAPHY, (+ITEM 23 of 27) User14783 22nov80 1242

PLASMAS, Measurements).
CARD ALERT: 744, 932
DETERMINATION OF THE INHOMOGENEOUS STRUCTURE OF A MEDIUM FROM ITS PLANE WAVE REFLECTION RESPONSE. II. A NUMERICAL APPROXIMATION

Candel, S.M.: DefilliPi, F.: Launay, A.
Ecole Centrale des Arts et Manufactures, Chatenay-Malabry, France

J. Sound and Vib. (GB) Vol. 68, No. 4 583-95 22 Feb. 1980
Coden: JSVIAG

A numerical approximation can be developed to determine the sound speed and density structures of an inhomogeneous medium from its plane wave reflection response. The problem is solved by means of a simple numerical technique that involves only fast Fourier transform operations and numerical integration of ordinary differential equations. Three cases are specifically considered: sound speed is unknown, density is known; sound speed is known, density is unknown; and sound speed and density are to be determined simultaneously. Numerical simulations performed on reflection coefficients computed previously for a limited band of frequencies lead to accurate reconstructions of the original structures of various media.

Descriptors: Wave propagation; Numerical analysis
Identifiers: Plane wave reflection; Numerical approximation; Inverse scattering; Reflection response; Inhomogeneous medium; Numerical integration; Ordinary differential equations; Reflection coefficients; Fast Fourier transforms; Electromagnetic waves; Acoustic waves; Ocean surface waves

Section Class Codes: AO340K, AO260
The paper addresses the numerical solution of linear Fredholm I integral equations of the type arising from various one-dimensional inverse scattering problems. Typically when these equations are discretized they lead to very ill-conditioned algebraic systems. It is shown that for these types of kernels a relatively simple mesh adapting scheme leads to very well-conditioned systems. Moreover, when the kernel is not known explicitly but must be generated by numerically solving a boundary-value problem, it is shown that an asymptotic analysis can extract the information necessary to successfully adapt this mesh.

Identifiers: Numerical Solution; Kernels; Boundary-Value Problems; Inverse Scattering Problem; Fredholm Equation