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NAGPUR—1974

PART III

ABSTRACTS

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GROUP A

PROCEEDINGS
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Abstracts

SECTION OF MATHEMATICS

President : R. S. KUSHWAHA

APPLIED MATHEMATICS

Elasticity

1. Effects of Nonhomogeneity on the Deformation and Stresses in an Earth Model with a Rigid core.

R. N. CHATTERJEE, Santiniketan

The present paper is concerned with the effects of non-homogeneity in respect of rigidity on the deformation and stresses in the interior of the earth considered as a self-gravitating isotropic sphere having a rigid core at the centre. The density distribution and gravitational body force in the interior of the earth corresponds to the model Y_1 proposed by B. A. Bolt (1957). The modulus of rigidity of the mantle is assumed to vary inversely as the m-th power of the radial distance from the centre of the earth. Stresses and displacement are expressed in terms of elementary functions.

2. Propagation of Rayleigh waves on Cylindrical Surfaces of Aeolotropic Material of Varying Density placed in a Magnetic field

B. G. VERMA, Gorakhpur

In this paper the propagation of Rayleigh waves on cylindrical surfaces of aeolotropic material and varying density, in a magnetic field has been discussed. The density ρ of the material is assumed to be of the form $\rho = \rho_0 r^s$ where ρ_0 is a constant and S is any integer.

3. Two Circular Arcs Problem in an Infinite Isotropic Elastic Plate

R. D. BHARGAVA and RAM NARAYAN, BOMBAY

A homogeneous isotropic elastic infinite plate contains two symmetrical circular arc cracks, of equal radii and having the same centre. The cracks need not necessarily

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be equal. Th plate is subjected to a uniform tension at infinity. The above elasticity problem is solved in this paper. The complex variable method is employed and analytical solution obtained. In general case, when arcs are unequal, integrals involved are complicated and cannot be evaluated directly. For obtaining explicit solution, one has to take recourse to numerical integration. However, for equal arcs, exact analytical solution can be found. Some numerical results pertaining to the latter case are given.

4. Stresses in a tube of Cylindrically Aeolotropic Electrostrictive Dielectric under radial Electric field and constant Internal pressure.

M. N. Lal and B. L. Das, Ranchi

This paper deals with the problem of determining the stress distribution in a cylindrically aeolotropic electrostrictive dielectric in the form of a hollow tube, under constant internal pressure and radially varying electric field. The constitutive equation of an electrostrictive material characterized by cylindrical aeolotropy has been obtained by superposing the constitutive equations for the elastic field and the electric field. The permittivity of the material has been assumed to be varying linearly with the radius. The displacement and hence the stress distribution has been calculated.

5. On the Problem of Stamp of Dumb-bell shape in Three Dimensions

S. C. Das Gupta, Howrah

The problem of hollow in two-dimensions in the shape of dumbbell which is inversion of elliptic curve with respect to the centre is solved by conformal transformation. In three dimensions the problem of stamp in the shape of a dumb-bell requires solving by using the theory of potentials. Using the known property that if $f(x, y, z)$ satisfies the harmonic equation, then

$$\frac{1}{S} f\left(\frac{x}{S^2}, \frac{y}{S^2}, \frac{z}{S^2}\right) (S^2 = x^2+y^2+z^2)$$

also satisfies the same equation. So, we can write the harmonic function in the form

$$\frac{1}{\sqrt{x^2+y^2+z^2}} \int_{\xi}^{\infty} \frac{\phi[\rho(s)]}{\sqrt{Q(s)}} ds,$$

where ξ, η, ζ are the inverted elliptic co-ordinates of a point and

$$\rho(s) = 1 - \frac{1}{(x^2+y^2+x^2)^2}\left[\frac{x^2}{a^2+s} + \frac{y^2}{b^2+s} + \frac{z^2}{s}\right], \; Q(s) = s(a^2+s)(b^2+s)$$

and $\xi = 0$ represent points within the dumb-bell shaped curve on the surface $z = 0$. Writing stresses and displacements under simplified condition on the surface $z = 0$ that the stresses $\tau_{xz} = \tau_{yz} = 0$, in terms of a single harmonic potential, we obtain an Abel-type integral equation for solution for given displacement $u = q(x, y)$ outside the dumb-bell area and $u_z = 0$ inside.

6. On the Effect of a Rigid Inclusion in the Form of an Ovaloid Embedded in a Beam Under the Influence of a Constant Transverse Load

SMRITI KANA MAJUMDAR, Santiniketan

This paper deals with the influence of a small rigid ovaloidal inclusion embedde in a cantilever under constant transverse load applied to one end. Muskhelishvili's method is followed in solving the problem.

7. Rayleigh waves in Electrostrictive Dielectric Slids

GUNADHAR PARIA, Indore

It has been shown that an electrostrictive dielectric material can propagate Rayleigh waves. The applied surface potential induces body forces and surface tractions. The body forces are not induced if the dielectric has not the property of electrastiction. The surface tractions are however present even when electrostrictive property is ignored.

8. Thermal Stresses in an Elastic Inhomogeneous composite Disk of Variable Thickness Rotating about Central Axis

D. P. GUPTA and B. G. VARSHNEY, Ranchi

In the present paper, thermal stresses in an annular, thin and elastic inhomogeneous composite disk which is partly isotropic and partly anisotropic and is of variable thickness are determined when the disk is subjected to a temperature field which is subjected to a temperature field which is a power function of the radial distance r, and the disk is rotating uniformly about its central axis. For the inner annular isotopic portion, the Young's modulus of elasticity varies inversely as the n-th power of the radial distance and for the outer cylindrically anisotropic portion the elastic copliances are directly proportional to the n-th power of the radial distance. The variable thickness of the disk is $2h(r)$, where $h(r) = h_0 r^{-\lambda}$, h_0 and λ being constants. The particular cases of completely isotropic annular disks of elastic inhomogeneous or homogeneous material and of an elastic homogeneous composite disk of uniform thickness and without hole are deduced.

9. SH-wave Propa gation due to an Arbitrary Source in two welded Quarter-spaces

M. MITRA, Howrah

The problem of wave-progagation in two welded quarter-spaces is important in seismology.

A method of solving the problem exactly is given and is applied to the case of an arbitrary source in one quarter-space. The method reduces the problem to an integral equation without using Green's functions and solves the problem by transform methods.

Relativity

10. On Magnetofluids in General Relativity

G. G. ASGEKAR, Kolhapur

The stress-energy momentum tensor formulated by Date (1973) for viscous, compressible, non-inductive, self-gravitating fluid with variable magnetic permeability is considered. Jackson's (1972) result on finite amplitude sound propagation equation for perfect fluid is extended to magnetofluids. 'Macroscopic' Bianchi identities (Szekeres 1971) and Maxwell-type equations (Ellis 1971) are deduced for the magneto-fluids. In conformally flat space-times it is shown that for an essentially shear-flow the divergence of heat flux depends on magnetic field in addition to viscosity, while for an essentially accelerating flow heat flux is covariantly constant.

11. Exact Lichnerowicz Universes

T. H. DATE, KOLHAPUR

The author has recently developed a formalism for the study of charged, viscous, compressible non-inductive fluid in the general theory of relativity. In the absence of heat flux and viscosity, the formalism reduces to Lichnerowicz's (1967) theory of thermodynamical fluid with infinite electrical conductivity and constant magnetic permeability. Local behaviour of congruences and exact solutions of Lichnerowicz field equations in spherically symmetric space-times are found to be the generalizations of the solutions obtained by McVittie, Schwarzschild, de-Sitter, Nordstrom-Jeffery, Bonnor and Das. Even if the perfect *fluid* distributions are incompatible with cylindrically summetric space-times, it is shown that the perfect *magnetofluids* are compatible. The Einstein-Rosen metric is considered to obtain a class of non-static and static solutions of Lichnerowicz's field equations. Exact cylindrically symmetric Lichnerowicz universes found in this paper are analogous to Radhakrishna's (1963) investigations on cylindrically symmetric electrovac universes.

12. A Conformally Flat Non-Static Perfect-fluid Distribution

K. P. SINGH and ABDUSSATTAR, VARANASI

In this paper a non-static generalization of Schwarzschild interior solution has been obtained which is conformal to flat space-time.

13. Non-symmetric Problems in General Relativity—I

BIDYUT KUMAR DATTA, Calcutta

The Cauchy problem for a perfect fluid is studied by introducing co-moving coordinates. A new solution is obtained on the assumption that all the thermodynamic processes are adiabatic and that only mechanical energy may be released in the process.

14. On Material Schemes in Relativistic Magnetohydrodynamics

L. RADHAKRISHNA and R. R. SHAHA, Kolhapur

Definite magnetofluid schemes are defined as definite material scheme in relativistic magnetohydrodynamics when the magnetic field vector is a principal vector of the stress-energy tensor. The field equations governing such schemes are proposed and tetrad formalism is developed to study special types of flows. Expaension-free, Born rigid time-like congruence and covariant constant space-like congruence are examined. Spherical and plane symmetric space-times admit such schemes only when the Segre characteristic of the stress-energy tensor is [3 1].

15. Ricci Collineations and Motions in General Relativity

L. RADHAKRISHNA and V. D. KHADE, Kolhapur

Ricci collineations and motions as preferred infinitesimal point transformations in the general theory of relativity and the corresponding conservation laws are summerised. The instances when Ricci collineation along the preferred congruences in relativistic magnetohydrodynamics implies the motion along the same are obtained. In particular, for relativistic hydrodynamics it is shown that the collineation implies motion only for non-Zeldowich fluids. However, for incoherent matter collineation inevitably implies motion.

Fluid Mechanics

16. Slow and Steady flow of a Viscous fluid within two Rotating Co-axial Surface of Revolutions formed by the Revolution of two Cardioids

K. SENGUPTA, Santiniketan

Slow and steady flow of an incompressible viscous fluid within two rotating surfaces of revolutions is studied here. The surfaces of revolutions are obtained by revolving two co-axial cardioids about their common axis. The surfaces are rotating steadily with different angular velocities about their common axis. The problem is solved and expressions for moments exerted on the boundaries are obtained.

17. Motion of a Viscous Incompressible Liquid due to a Surface Pressure

DILIP KUMAR DAS, Darjeeling

In this paper, we have considered the motion of a semi-infinite incompressible viscous fluid under the action of a radially symmetric pressure applied to the free surface. The liquid is initially at rest and waves are generated by the action of a pressure distribution $f(r, t)$ which is suddenly applied on the free surface. Displacement of the free surface has been calculated for different pressure distribution.

18. FINITE Element Model of a Non-Linear Boundary value Problem for Unsteady flow of Gas

P. C. JAIN and P. K. MAHANTI, Bombay

Finite Element Technique has been used extensively in attacking linear problems with complicated boundaries. Its use in the general area of solid Mechanics has helped in tackling several difficult problems. Little has been done in modifying the technique for solving nonlinear problems. In this paper, a finite element model of a nonlinear boundary value problem is proposed by making use of the idea of weighted residuals.

19. Laminar Boundary Layers in an Oscillatory Viscoelastic flow along an Infinite flat plate with variable Suction.

B. SIDLAPPA and N. M. BUJURKE, Gulbarga

The two dimensional incompressible viscoelastic fluid (Rivlin-Ericksen) flow along an infinite plane porous wall is considered. The suction velocity normal to the wall and external flow are assumed to be periodic. Expressions for the velocity distribution inside the boundary layer and skin friction are obtained, and it is found that the skin friction decreases for $wt+\phi = \pi(n+\frac{1}{2})$, $n = 0, 1, 2, \ldots$.

20. Slow flow of Rivlin-Ericksen Fluid between two Opposed Surfaces with Uniform Injection

B. SIDDAPPA, and B. S. KHAPATE, Gulbarga

In this paper solution to the slow flow of Rivlin-Ericksen fluid between two opposed surfaces with uniform velocity of injection through one surface is found. Velocity profile is sensibly independent of cross-viscosity but pressure depends on the cross-viscosity.

21. A Numerical Analysis of flow Photographs—I Strcam-lines of flow past a circular cylinder with and without Vortices

N. L. GHOSH, and M. L. MASANTA, Burdwan

This paper contains a statistical analysis and a numerical verification that the flow lines past a cylinder, as shown by photographs, satisfy the equations for the stream-lines in irrotational motion in two cases : (i) when there is no wake and (ii) when there is a wake containing a pair of symmetrical vortices.

22. A Numerical Analysis of flow Photographs—II. Circular Cylinder with a pair of Vortices (Contd.)

N. L. GHOSH and M. L. MASANTA, Burdwan

This paper contains a numerical verification of some of the details of the flow pattern past a cylinder with a pair of vortices. Sec. A predicts the stagnation points

and show how far they are borne out by actual measurements. Sec. B determines the equation of the dividing stream-line. Sec. C obtains the velocity distribution on the boundary and Sec. D verifies the pattern of the stream-lines inside the wake.

23. On the Possibility of Homologous Motion of a Gravitating Heat Conducting Gas Sphere

G. BANDYOPADHYAY, Kharagpur

The equations corresponding to the above problem have been investigated and it is concluded that though near-homologous motion may be possible, strict homologous motion is ruled out. If, however, conductivity changes in a certain way, very slowly with temperature, strict homologous motion is possible.

24. Incompressible Fluid with General Internal Motions : Polytropic Stellar Configuration

V. K. GURTU, Nagpur

In the present paper a polytropic stellar configuration with general internal motions represented by the velocity $\bar{v}$ such that $\bar{v} \times \text{curl } \bar{v}$ is expressible as a gradient of a scalar has been obtained.

25. Laminar-Non-Newtonian flow through a Porous Annulus

AVIMANYU ROY, Rourkela

This paper confines to the study of the laminar flow of a non-Newtonian liquid under constant pressure gradient in an annulus when outer cylinder moves with a constant velocity and the fluid injection rate at one wall be equal to the fluid suction rate at the other wall. The effect of in-elastic number R_e on the axial velocity profile, flow reversal and pressure gradient normal to the flow direction is studied.

Magneto Hydro Dynamics

26. Unsteady flow through an Annulus in the Presence or Absence of a Magnetic Field

K. K. MANDAL and B. BASU, Burdwan

In this paper, the flow of a viscous incompressible electrically conducting fluid through an infinitely long annulus due to general time dependent pressure gradient under the influence of a radial magnetic field has been investigated. The results of the corresponding hydrodynamic problem have been indicated and some special cases have been discussed.

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27. Plane Parallel slip flow of Dusty Gas with Transverse Magnetic Field

U. Basu, Calcutta

The present work is an attempt to study the flow of a conducting gas occupying a semi-infinite space above a rigid non-conducting plane boundary in the presence of uniform magnetic field. In the gas, uncharged particles are suspended and are in motion. Here a solution is obtained by using an initial condition duly modified from kinetic-theoretic consideration and slip boundary conditions. After the suggestion of Reddy [6] rough modification to the initial condition of the problem in the slip flow has been taken in such a way that the correct values for the skin fricton and velocity of slip at the wall at initial instant are assured. The motion induced in the dusty gas where the plane moves parallel to itself (i) impulsively from rest with uniform velocity, (ii) impulsively start from rest with small amplitude oscillations. The initial condition of the problem is that the fluid velocity $u = \phi(y)$ at $t = 0$ where $\phi(y)$ is the initial velocity profile, when the fluid adjacent to the wall acquires a non-zero velocity due to sharp readjustment of the molecules almost simultaneously with the motion of the plate. The problem is solved by Laplace transform method and exact solution is written by Contour Integral form. The integrals have been evaluated for small time and large time. For small time there is no effect of magnetic field on the velocity profile. The effect of magnetic field is found for large time approx imation.

28. On Generalized Fluctuating Hartmann flow

Subhash Ch. Sikdar, Calcutta

The flow of viscous fluid between two fixed boundaries is referred to as poiseiulle flow. Hartmann, in his well known paper, considers the steady flow between two (fixed) parallel non-conducting walls with the applied magnetic field normal to the walls.

In this paper the unsteady flow of conducting, viscous incompressible fluid between two parallel plates in presence of a transverse magnetic field has been studied. The upper plate moves with a constant velocity U and the lower plate is fixed. Only one component of the velocity and induced magnetic field are assumed. The flow is along the x-axis and the applied magnetic field is along the y-axis. A no slip condition of the velocity is assumed on the non-conducting walls. The plates are separated by a distance 2L so that the boundary condition is $v = U$ at $y = +L$ and $v = 0$ at $y = -L$. Method of perturbation has been applied to obtain the velocity distribution and the induced magnetic field. The velocity distribution in the non-magnetic case has also been studied and is compared with the magnetic case with different Hartmann numbers. It is seen from the graph that the velocity profile for larger Hartmann number gradually flattens. The flattening increases with the increase of the Hartmann number.

29. On Unsteady Magnetohydrodynamic Boundary Layer flows

Mrs. Swapna Sen, Calcutta and Lokenath Debnath U.S.A.

An unsteady analysis is carried out of the magnetohydrodynamic boundary layer flows generated in a semi-infinite expanse of an incompressible, homogeneous, viscous, electrically conducting fluid by an infinite flat plate which executes small amplitude

harmonic oscillations in its own plane. The unsteady velocity distribution and the induced magnetic field are determined explicitly by using the Laplace transform with suitable approximations. The structures of the boundary layers and the current layers including the flow outside these layers are examined. The initial and the final states of the motion of the fluid are investigated with physical implications. It is shown that the solution consists of the hydromagnetic boundary layers, current layers and the diffused Alfven waves. It is also found that the ultimate steady state solution consists of two different hydromagnetic waves which propagate with velocities V_A and $2V_A(n\nu)^{\frac{1}{2}}/n+\nu$. One of these waves in an Alfven wave which decays exponentially over a distance $2V_A^3/\omega^2(n+\nu)$ and the other is also damped out exponentially in the Hartman layer of thickness of the order $(n\nu/V_A^2)^{\frac{1}{2}}$. Several special cases of interest are discussed.

30. Non-similarity Solution for Cylindrical Blast Waves in Magneto-gas Dynamics

G. Deb Ray, Calcutta

Non-similarity solutions in closed-forms, for a sufficiently energetic line-explosion, in the presence of a constant axial current, are obtained. The gaseous medium is of constant pressure and its density varies as some inverse power of the distance from the line of explosion; ω is the power index, lying in the interval $0 \leqslant \omega < 2$. The disturbance is headed by cylindrical shock surface of variable strength. The total energy of the wave is non-constant, but can be made to vary slowly with time.

31. Three-Dimensional Analysis of the Density Wave Model with the Inclusion of Magnetic Field.

A. K. Roy, Calcutta

The density waves of the most general pattern with the inclusion of magnetic field have been discussed here and attempts have been made to interpret various results obtained therefrom and to show how they propagate in different parts of the Galaxy. Using the values of the various parameters across the entire region of the Galaxy as have already been obtained the analysis has been found to be capable of explaining (i) the instability of all density waves in the central region of the Galaxy (ii) the large scale distortion of the gas in the outer region and (iii) the stability of all modes in the principal part of the Galaxy. The analysis also confirms the unusual dynamical behaviour of the gas in the 3 kpc region as well as a high degree of axial disturbance in the 2-5 kpc region.

32. Universal Stability Criterion for Ferro-fluids

P. C. Jain and C. V. S. Prakash, Bombay

Convective stability of Boussinesq ferro-fluids in a bounded region under the action of a constant magnetic-field-gradient is discussed in this paper. The magnetic moment is taken to be an arbitrary function of the magnetic field and temperature but is assumed to have a definite bound for its first and second partial derivatives. It is

seen from the ferro-magnetic theory that this magnetic moment has a convex downward surface in appropriate intervals with respect to the state variables. This is used to obtain a stability criterion in terms of a newly defined Rayleigh number. It is also shown that the subcritical instability in case of a stationary convective flow is eliminated for ferro-fluids.

33. Propagation of Strong Shocks in Self-gravitating Conducting Gases in Stellar Models

B. G. VERMA and BALESHWAR PRASAD, Gorakhpur

Following Sedov (1967), who studied the self-similar motion for instantaneous explosion, and Korobeinikov (P.M.M. (1959), 23, 384), who solved a problem of non-self similar motion in a non-gravitational field with constant explosion energy, this paper considers the problem of uniform propagation of strong shocks in self-gravitating conducting gases in stellar models. Because of simplicity and qualitative results that it produces, only the first approximation solution has been obtained by using Runge-Kutta methods.

34. Instabilities in Double Phase flow through Porous Media with Variable Magnetic Field

A. P. VERMA, Surat

The paper analytically discusses the phenomenon of instabilities in displacement problems involving two immiscible liquids through porous media with variable magnetic field. The basic assumptions underlying the present investigation are that the injected liquid is conducting and less viscous while the native liquid is nonconducting and relatively more viscous, and the behaviour of the instabilities is governed by a statistical treatment. The basic equations of the flow system coupled with analytical consideration for additional physical effects yield a nonlinear differential equation whose approximate mathematical solution has been obtained by a perturbation method.

35. Nonlinear Longitudinal Oscillations in a cold Plasma in presence of External Periodic Electric Field

S. P. PAL, Darjeeling

The longitudinal fields in an infinite, cold, collisionless electron plasma in an external space-independent but time-varying electric field are considered. Here one dimensional macroscopic equations together with Maxwell's equations are solved exactly as an initial value problem by utilising the fact that from these equations a set of quasi-linear partial differential equations having identical principal parts can be derived. Here two initial conditions are considered. In the first case when the plasma is assumed to be initially homogeneous and the velocity and the induced electric field are given uniform initial values, the density is found to retain its initial value and the velocity and the electric field appear as superposition of two longitudinal oscillations, one oscillating with the plasma frequency and the other with the frequency of the external field.

In the second case when the plasma is assumed to be initially inhomogeneous and at rest, the field variables are found implicitly as solutions of transcendental equations. Under the approximation of small wave numbers and small initial inhomogeneity, simple expressions are obtained for the field variables.

36. Instability of Ion-Acoustic Wave in presence of a Uniform Electronic Field

SUKLA MUKHERJEE, Calcutta

The stability of longitudinal wave propagation in an arbitrary direction in a homogeneous fully ionized plasma in presence of a uniform d.c. electric field is considered, the effect of collision being taken into account. Dispersion relation fo low frequency ion acoustic wave is obtained by solving the kinetic equation with Bhatnagar-Gross-Krook collision model, by perturbaion technique and by the method of integration over the unperturbed orbits. The second order correction of the electric field on both the ion-acoustic frequency and the attenuation coefficient are given explicitly. It has been investigated that the more inclined is the wave vector with the direction of the applied electric field, the less affected is the wave by the field and as a result threshold for instability increases with the increase of the angle of inclination of the wave vector with the electric field. The stable and unstable regions for the low frequency wave are shown graphically.

37. On Force-free Magnetic Fields

V. K. GURTU, Nagpur

Axi-symmetric and asymmetric force free magnetic fields have been reconsidered from a different point of view. It is shown that, in general, if any two components (provided they are not identical) of the Lorentz force are zero, the corresponding field must be a force-free magnetic field. In the case of axi-symmetric magnetic field it is shown that 'α' introduced by Ļust and Schlüter as some function of position is merely a known constant, thus establishing that the current density is not only parallel to but is also proportional to the Magnetic Field. As regards asymmetric force-free fields, it is conjectured that such fields do not exist in nature.

Miscellaneous

38. Bounds for Phase-shifts and Deductions in Potential Scattering

B. G. SIDHARTH, Calcutta

In this paper bounds for phase-shifts δ_l are shown when $|\delta_l| < \pi/2$. Next, the behaviour of these bounds is investigated, as l changes. From this, amongst other things, the following are deduced :

A necessary and sufficient condition for the feasibility of the partial-wave analysis.

Sufficiently low energy scattering is isotropic.

Bounds for the scattering length and approximate expressions for small phase shifts and the scattering length.

A recurrence relation for the small phase-shifts for Gaussian potentials.

39. On Monosplines

BRAHMA NAND MISHRA, Jamshedpur

Spines are of recent origin and are extremely versatile in applications. The research in this area of approximation theory is continuing in a steady pace.

The first published result on approximation by monosplines is due to R. S. Johnson. He has studied Monosplines of Least Uniform deviation by piecing together the segments of the Tchebycheff polynomials. Schoenberg has investigated some results on correspondence between monosplines and optimal quadrature formulae.

In this paper we study some results in the context of ordinary spline polynomials although most of the results generalizd to the context of Tchebycheffian splines.

The chief aim of this paper is to consider applications and generalizations of the fundamental theorem of algebra for 'Monosplines' vanishing at prescribed points and also obeying suitable boundary constraints.

40. Some Applications of Laguerre Polynomials in Quantum Mechanics

GIRDJAR BIHARY, Patna

A method has been developed to transform the hypergeometric equation to the form of the radial Schrodinger equation. The values of solvable potentials have been found in terms of Lagnerre polynomials.

41. On an Integral Equation of Electrostatic Problems

S. L. KALLA

The object of the present paper is to consider the integral equation,

$$\int_0^a \frac{f(x)}{(x+y)^{2\alpha}} F\left(\alpha, \alpha-\beta+\tfrac{1}{2};\ 2\alpha-2\beta+1;\ \frac{4xy}{(x+y)^2}\right) dx = g(y),$$

$$0 \leqslant y \leqslant a, \quad 0 < \alpha < 1,$$

which is encountered in many electrostatic problems. The result given earlier by Lebedev [Zh. Tekh. Fiz., 18(1948), 775] follows as particular case of our result established here.

42. Diffusion of Heat in a Cylinder which is Generating Heat

S. L. KALLA, A. BATTING and R. LUCCIONI, Tucuman-R. Argentina

In the present paper we have considered the problem of diffusion of heat in a semi-infinite solid circular cylinder which is generating heat. The faces $z = 0$ and $r = a$ of the cylinder of radius a, are maintained at prescribed temperatures and there is an initial distribution of temperature throughout the medium. The solution is obtained by an appeal to the finite Hankel transform and Fourier sine transform. Some particular cases are given. The solution obtained is interpreted numerically by using an IBM 1620 computer. Figures are drawn to indicate the temperature distribution in the medium.

43. Tabla de Raices de Ecuaciones Transcendentes Associadas con Transformaciones Integrales

RAUL E. LUCCIONI, Tucuman, R. Argentina

In this work we have obtained twenty five roots of the transcendental equation, $hJ_0(\xi)-\xi J_1(\xi) = 0$, $h > 0$, upto ten places of decimal for a fixed positive $h(h = .01, .02, \ldots,)$. The zeros of the Bessel function of the first kind of order 0 and 1 respectively are tabulated. The roots of the transcendental equation, $J_\nu(b\xi)\, Y_\nu(a\xi)-J_\nu(a\xi)\, Y_\nu(b\xi) = 0$, where $J_\nu(x)$ and $Y_\nu(x)$ are the Bessel functions of the first and second kind respectively of order ν are tabulated for the case $\nu = 0, 1$, $b = 1$, $a = 2$. In both the cases 50 roots are calculated $(\xi_1, \ldots, \xi_{50})$, upto ten places of decimal. All the tables are prepared by using the IBM computer 1620. We hope that the tables will be useful to research workers in the fields of mathematical physics and engineering.

Functional Analysis

44. On an Iterative Method of Solving Bounded Linear Operator Equations

RABINDRANATH Sen, Kalyani

This short paper presents an approximate iterative method of solving equations of the form $Au = f$, where A is a bounded linear operator in a reflexive Banach space X and f is a given element of the space. The concept of semi-inner product in a reflexive Banach space has been utilized to frame the criterion for the existence and uniqueness of the solution. No knowledge about the initial approximation to the solution is necessary to start the iteration.

Error estimates have also been derived.

45. Operaters Unitarily Equivalent to their Adjoints

N. C. SHAH and I. H. SHETH

An operater T defined on a Hilbert space H is said to be hyponormal if $||T^*x|| < Tx||$ for all $x\epsilon H$, quasi-hypnormal if $||T^* Tx|| < ||T\, Tx||$ for all $x\epsilon H$, and paranormal if $||T\, X||^2 < \|T^2x\|$ for all unit vectors $x\epsilon H$.

In this paper, we generalize the following theorem of T. Furuta and R. Nakamota and also proved other related results.

Theorem : *A hyponormal operator unitarily equivalent to its adjoint is normal.*

46. Some Extensions of a Theorem of Kannan

D. K. ROY CHAUDHURY, Calcutta

Let M be a complete metric space and T be a containuous mapping of M into itself. In the present paper we prove the following result along with some other results.

Theorem : *If for each x in M there is a posistive integer $n(x)$ such that*

$$d(T^{n(x)}x,\, T^{m(x)}y) < \alpha[d(x,\, T^{n(x)}x)+d(y+T^{m(x)}y)]+\beta d(x,\, y)$$

for all y in M, where α, β are independent of x, y, and $\alpha \geqslant 0$, $\beta \geqslant 0$, $2\alpha+\beta < 1$; and $m(x) = n(T^{n(x)}x)$. Then T has a unique fixed point.

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