

Book Review on Partial Differential Equations

By Phoolan Prasad and Renuka Ravindaran

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The book mainly helps us to deal with partial differential equations (PDE) in the branches of science and engineering which has a wide range of applications. As PDE has more than one approach to the study of contents. The book was useful for the students of the Science, Engineering, Technology, Philosophy streams who pursue their higher education. It is also useful for the Research Scholars, Scientists, and Teachers of various boards. It was both useful for the introduction of theory and the application which are correlated to each other. This requirement is not only rigorous, but it gives constructive proof which enhances the solution by this structure and properties of the theory. The book has emitted the major parts of the general approach which is by the study of linear operators. From the beginning of the contents of the book they preferred this effect to give the fast gaining in the field of non-linear as it is important. This book not only gives a rigorous introduction to theory of PDE but also details about the applications.

This book consists of three chapters. They are single first order PDE, linear second order PDE, and hyperbolic PDE, in this chapter it consists of two parts: they are equations in two independent variables and equations in more than two independent variables.

Chapter 1 is about single first order PDE which has sub-sections they are meaning of PDE, semi-linear and quasilinear equations in two independent variables, first order nonlinear equations in two independent variables, complete integral, first order equations in more than two independent variables, application of the theory of single first order equation. The first subsection includes first Order PDE in two independent variables and the Cauchy problem. The second subsection includes semi-linear equations,

quasilinear equations, the characteristic Cauchy problem, and general solution. The third sub-section includes Monge strip and Charpit's equations, solution of a Cauchy problem, solution of a characteristic Cauchy problem. The fourth subsection includes determination in higher dimensions, semi-linear and quasilinear equations in more than two independent variables, and nonlinear first order equations. The fifth sub-section includes an example: A wave equation, the Hamilton-Jacobi theory, traffic flow.

Chapter 2 is about linear second order partial differential equations which have sub-sections. They are classification of second order partial differential equations, potential theory and elliptic differential equations, the diffusion equation and parabolic differential equations, the wave equations. The first subsection includes linear equation in two independent variables, linear equation in more than two independent variables, the Cauchy problems, propagation of discontinues. The second subsection includes boundary value problems and Cauchy problems, singularity functions and the fundamental solution Green's function, Passion theorem, the mean value and the maximum-minimum properties, Dirichlet's principles, general second order linear elliptic equations. The third subsection includes the one-dimensional wave equation, the three dimensional wave equation, method of spherical means, the two dimensional wave equation: Hadamard's methods of descent, propagation of confined initial disturbances, continuable initial conditions, boundary value problem for the one dimensional wave equation, Riemann's method of linear hyperbolic equation.

Chapter 3 is about hyperbolic PDE. In this chapter it has two parts. The first part talks about a first order hyperbolic system which has sub-sections. They are definition of a first order hyperbolic system, linear and semi linear equations: Canonical Form, numerical solution, domains of dependence, influence and determinacy, propagation of discontinues along a characteristic curve, existence, uniqueness and stability of the Cauchy problem for a linear hyperbolic system. Comments on mixed initial and boundary value problems, Riemann's method for linear hyperbolic equation, hyperbolic system of two first orders quasilinear equations: Introduction of characteristic coordinates, linearization of a reducible system of quasilinear Equations by hodograph transformations, simple wave solution for a system of two equations, application of the theory simple waves in gas dynamics, general theory of a simple wave, weak solution of quasilinear equations.

In the Part B, it is about equations in more than two independent variables has sub-sections includes Cauchy problem and a characteristic manifold, the wave equation: space-like manifold and time like direction, algebraic criterion of hyperbolicity, uniqueness theorem for Cauchy problem, characteristic and rays, propagation of discontinues along rays. Hyperbolic system of first order equation: Normal conoid, characteristic conoid and definition if the hyperbolic system, Bi-Characteristic curves and rays, compatibility condition along characteristic manifold, propagation of discontinuities of first order derivatives along rays.

This book is useful for the students' pursuing masters in various fields having PDE as one of their subjects.

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REFERENCES

- [1] Phoolan Prasad and Renuka Ravindaran, "Partial Differential Equations," New Age International Publishers, 1996.

BIOGRAPHIES



D. Vivek received the B.Sc. Degree in Mathematics from Ooty Govt. Arts College in 2010, M.Sc. Degree in Mathematics from Sri Ramakrishna Mission Vidyalaya College of Arts & Science in 2013 and the Ph.D. degree in Mathematics from Sri Ramakrishna Mission Vidyalaya College of Arts and Science in 2019. He is currently working as Assistant Professor of Mathematics at PSG College of Arts & Science, Coimbatore, India. His research interests include Fuzzy Differential Equations, Numerical Solutions, and Fractional Differential Equations.



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