Preface

The theory of time scales was introduced by Stefan Hilger in his PhD thesis [6] in 1988 (supervised by Bernd Aulbach) in order to unify continuous and discrete analysis and to extend the continuous and discrete theories to cases "in between." This book presents an introduction to the theory of partial dynamic equations (PDEs) on time scales. The book is primarily intended for senior undergraduate students and beginning graduate students of engineering and science courses. Students in mathematical and physical sciences will find many sections of direct relevance. This book contains ten chapters, and each chapter consists of results with their proofs, numerous examples, and exercises with solutions. Each chapter concludes with a section featuring advanced practical problems with solutions followed by a section on notes and references, explaining its context within existing literature.

In Chapters 1 and 2 are considered the classification and canonical forms for second-order PDEs. Chapter 3 is concerned with the Laplace transform method. The Laplace transform is applied for solving second-order PDEs. Chapter 4 is devoted to the Fourier transform method; Fourier transform is defined and some of its properties are presented. The Fourier transform is applied for solving second-order PDEs. The method of separation of variables is considered in Chapter 5. Three kinds of eigenvalue problems on time scales are considered. Sobolev-type spaces and generalized derivatives are introduced. The method of separation of variables is applied for solving some classes of second-order PDEs. The method of factoring for first-order and second-order PDEs is investigated in Chapter 6. Chapter 7 is devoted to the wave equation; the Cauchy problem for the homogeneous and nonhomogeneous wave equations is also considered. Chapter 8 deals with heat equation. The weak maximum principle is proved, and its applications is given an a-priori estimate of the solutions of the heat equation; also proved is the stability of the solutions of the heat equation. They are given some particular solutions on some time scales. In Chapter 9, the Laplace equation is investigated; its weak maximum principle is proved, and its application in investigating the stability of the solutions of the Poisson equation presented. Chapter 10 is devoted to the reduction of some nonlinear PDEs to the wave equation, the heat equation, and the Laplace equation.

The aim of this book is to present a clear and well-organized treatment of the concept behind the development of mathematics as well as solution techniques. The text material of this book is presented in a readable and mathematically solid format.

The author would like to thank Dr. Zennir Khaled for a careful reading of the manuscript.

Paris
December 2024

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https://doi.org/10.1515/9783111636146-201