Preface

This book is the consolidation of the selected articles by the participants of the International Winter Workshop on Differential Equations and Numerical Analysis (DEANA 2015), held during 5–7 January 2015 at Bishop Heber College, Tiruchirappalli, India. Though the conference was intended to accommodate works on differential equations, the main concentration was on equations whose solutions and their derivatives are non-smooth with singularities related to boundary layers. Most of the works were on singular perturbation problems whose solutions exhibit initial/interior/boundary layers and occur in many physical phenomena.

With the presentation of the paper "On the motion of fluids with very little friction" by Ludwig Prandtl in 1904, in the International Congress of Mathematics, held in Heidelberg, Germany, the field of classical fluid dynamics got revolutionized. This led to the development of boundary layer theory and singular perturbation problems. Typically, these problems arise in various fields of applied mathematics such as fluid dynamics (boundary layer problems), elasticity (edge effect in shells), quantum mechanics (WKB problems), electrical networks, chemical reactions, control theory, gas porous electrodes theory and many other areas. The Navier–Stokes' equation with a large Reynolds number is one of the most striking examples of singular perturbation problems.

The aim of the conference was to give the young researchers the core of the subject for which pioneers in this area of research were invited from India and abroad. The invited talks were given by Prof. John J.H. Miller, Professor Emeritus, Trinity College, Dublin and Director, INCA, Dublin, Ireland; Prof. Eugene O'Riordan, School of Mathematical Sciences, Dublin City University, Ireland; Prof. N. Ramanujam, Honorary Professor, Department of Mathematics, Bharathidasan University, Tiruchirappalli, India; Dr. S. Valarmathi, Associate Professor and Head, Department of Mathematics, Bishop Heber College, Tiruchirappalli, India; and a few others. Also, there were contributions from various researchers working on differential equations and numerical analysis.

The book consists of two parts. Part I includes lectures by the invited speakers. The chapter "Elementary Tutorial on Numerical Methods for Singular Perturbation

Problems" gives a tutorial on singular perturbation problems. The chapter entitled "Interior Layers in Singularly Perturbed Problems" presents an introduction to interior layers occurring in the solution of singular perturbation problems. In the chapter "Singularly Perturbed Delay Differential Equations and Numerical Methods", an introduction about the applications and various methods of solving delay differential equations are presented. In the chapter "Initial or Boundary Value Problems for Systems of Singularly Perturbed Differential Equations and Their Solution Profile", a sketch of the analytical and numerical results for initial/boundary value problems for systems of singularly perturbed differential equations is given. In Part II, six refereed contributions of people working in the area of singular perturbation problems are included.

We are grateful to the invited speakers, the authors of contributed papers and to the unnamed referees for their valuable contributions, without which this volume is not possible. We acknowledge with sincere thanks the financial support extended by the University Grants Commission, Government of India and the National Board for Higher Mathematics, Government of India, to conduct the conference. Thanks are also due to the members of the organizing committee and the Principal and the management of Bishop Heber College. Our special thanks are also due to Mr. Kennet Jacob Jaisingh, software consultant, who designed the logo of DEANA 2015, constructed the website and helped us to have the book of abstracts, the brochure, etc., in the stipulated time.

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