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## Preface

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**Biographical notes:** C.V. Pao is an Emeritus Professor at North Carolina State University. He has published extensively in the area of partial differential equations, including a book entitled *Nonlinear Parabolic and Elliptic Equations* published by Plenum Press in 1992. Most of his work involve mathematical and numerical analysis of nonlinear parabolic and elliptic equations in bounded and unbounded domains, including systems with time delays, cross-diffusions, degeneracy or singularity, and applications of the above systems to various biological, chemical, physical and engineering problems. He has served on editorial boards of many research journals, including *International Journal of Dynamical Systems and Differential Equations*.

Wei H. Ruan is a Professor of Mathematics at Purdue University Calumet. He has worked on broad area of nonlinear reaction-diffusion systems, strongly coupled systems of parabolic and elliptic equations, population dynamics, Einstein-Yang-Mills equations, perturbative quantum field theory, hyperbolic systems, and fluid dynamics in relation to blood flow in arterial networks.

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Degenerate and singular parabolic and elliptic partial differential equations have been an active research area for many years, and are currently a rapidly growing field. The research has been motivated by the study of many reaction-diffusion-convection type processes in natural sciences, and in return the mathematical research is providing deep insight into the understanding of physical phenomena. On the one hand, degenerate and singular differential equations are more realistic than their uniform counterpart in many cases. On the other hand, degenerate and singular equations exhibit surprisingly new features which are absent without degeneracy or singularity. The mathematical treatments for these equations, however, are enormously challenging. Various approaches have been explored in the past two decades. However, it is fair to say that we are still at the beginning stage of charting this vast and complex area.

The papers included in this special issue represent the fronts of the research in several directions. Some of the papers establish the well-posedness of the initial boundary problems, others demonstrate novel phenomena and surprising behaviours, and still others obtain useful estimates as tools for future studies. The contributors were invited for their expertise in the area. Most of them have been working in this area for quite some time and have produced significant results. Their results presented in this issue, and perhaps even more importantly, their approaches employed here, will no doubt shed some lights for future studies.