Preface

This book is devoted to bifurcation theory in discontinuous dynamical systems. The main novelty is the consideration of bifurcation in differential and hybrid equations by means of methods developed by authors in recent years. Hopf bifurcation results are obtained for planar and three-dimensional systems. Results in nonautonomous bifurcation theory are presented for differential equations with discontinuities. This is the first time illustrations for nonautonomous bifurcation are provided. This theory is among vast developing subjects in the recent years. The subjects in this book are evolved from:

- Bifurcation theory for autonomous and nonautononmous ODEs;
- *B*—equivalence method is developed for impulsive differential equations with nonfixed moments of impacts and principles of discontinuous dynamical systems;
- Theory of differential equations with piecewise constant argument of generalized type; and
- Theory of differential equations with discontinuous right-hand side.

We expect that the results obtained in this book will be applied to various fields such as neural networks, brain dynamics, mechanical systems, weather phenomena, and population dynamics. Thus, we think that in near future this theory will be one of the most attracting areas in dynamical systems and its applications. Without any doubt, bifurcation theory should be further developed into other types of differential equation. In this sense, we strongly believe that the present book will be a leading one in this field. Bifurcation of periodic solutions and nonautonomous systems is yet to develop in multidimensional case. Center manifold theory is one of the interesting topics to investigate.

We have published several papers and books related to bifurcation theory in recent years. In this book, we provide results in discontinuous dynamical systems that are developed parallel to ODEs. The reader will benefit from recent results obtained in the theory of bifurcation and will learn in the very concrete way how to apply this theory to differential equations with various types of discontinuity: impulsive differential equations, differential equations with piecewise constant

argument, and differential equations with discontinuous right-hand side. Moreover, the reader will learn how to analyze nonautonomous bifurcation scenarios in these equations. The present book is devoted to Hopf, transcritical, and pitchfork bifurcations, and it is reasonable to discuss a new possibilities in other types of bifurcation such as Neimark–Sacker bifurcation, Shilnikov bifurcation, Bautin bifurcation, Bogdanov–Taken bifurcation, and bifurcation of almost periodic solutions.

This book will be of a big interest both for beginners and experts in the field of bifurcation theory. For the former group of specialists, that is, undergraduate and graduate students, this book will be useful since it provides strong impression that bifurcation theory can be developed not only for discrete and continuous systems but also for those which combine these systems in very different ways. The latter group of specialists will find in this book several powerful instruments developed for the theory of discontinuous dynamical systems with variable moments of impacts, differential equations with piecewise constant argument of generalized type, and Filippov systems. A significant benefit of this present book is expected to be for those who consider bifurcations in systems with discontinuities since they are presumably nonautonomous systems. Consequently, nonautonomous bifurcation is compulsory subject to discuss.

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