

Preface

This multi-author book reflects the present state of the art in bond graph modelling of engineering systems with respect to theory, applications and software support. Bond graph modelling is a physical modelling methodology based on first principles that is particularly suited for modelling multidisciplinary or mechatronic systems. Bond graphs were devised by Professor H. Paynter some 50 years ago at the Massachusetts Institute of Technology (MIT) in Cambridge, MA, USA. As to the pioneers of this methodology, the authors of this book are indebted to, among others, Professor D. Karnopp and Professor D. Margolis (University of California at Davis), Professor R. Rosenberg (Michigan State University, East Lansing, MI), Professor J. Thoma (Professor Emeritus at the University of Waterloo, ON, Canada) and Professor J.J. van Dichoorn (University of Twente, Enschede, the Netherlands).

Since the early days, bond graph modelling has evolved into a powerful rich methodology. Considerable progress has been achieved since then. Bond graph modelling has spread all over the world. It is used in engineering education as well as in industrial projects. Numerous bond graph-related papers have been presented in international conferences and published in refereed scientific journals. Furthermore, bond graph modelling has been used in many Ph.D. theses and has been the subject of a number of monographs and textbooks in various languages.

Beyond some special journal issues devoted to bond graph modelling, to the knowledge of the editor, very few multi-author books on bond graph modelling have been published during the past decades. One book to be mentioned is the 1991 compilation text *Bond Graphs for Engineers* edited by P. Breedveld and G. Dauphin-Tanguy. Another contributed book titled *Les bond graphs* was edited by G. Dauphin-Tanguy and published in 2000. A survey of bond graph-related publications suggests that it was time for a new collection that covers achievements and recent developments in bond graph modelling by integrating various works and presenting them in a uniform manner. On invitation by Springer, the editor of this book asked colleagues active in the realm of bond graph modelling for contributions. This book is the outcome of a truly international worldwide successful cooperation of excellent young researchers and those who have been using bond graphs and have been teaching the methodology for a long time. The book covers some theoretical issues and methodology topics that have been the subject of ongoing research during past years, presents new promising applications such as the bond graph modelling of

fuel cells and illustrates how bond graph modelling and simulation of mechatronic systems can be supported by software. This up-to-date comprehensive presentation of various topics has been made possible by the cooperation of a group of authors who are experts in various fields and share the “bond graph way of thinking”.

The aim of this contributed book is to reflect the current state of the art in bond graph modelling by presenting and discussing advanced recent topics. However, all chapters have been written in such a way that newcomers to the methodology with some knowledge of the basics may easily get into the vast fascinating and open field of advanced bond graph modelling. Readers who may want to have a closer look at bond graph fundamentals will find references to latest monographs and textbooks. Furthermore, each chapter provides many references to conference papers, journal articles and Ph.D. theses on advanced topics.

Bond Graph Modelling of Engineering Systems: Theory, Applications and Software Support addresses readers in academia as well as engineers in industry and invites experts in related fields to consider the potential and the state of the art of bond graph modelling. This multi-author book well complements latest monographs and textbooks on bond graph modelling and may serve as a guide for further self-study and as a reference.

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