



# **Bond Graph Methodology: Development and Analysis of Multidisciplinary Dynamic System Models**

*Wolfgang Borutzky*

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Nowadays, engineering systems are of ever-increasing complexity and must be considered as multidisciplinary systems composed of interacting subsystems or system components from different engineering disciplines. Thus, an integration of various engineering disciplines, e.g. mechanical, electrical and control engineering in a current design approach is required. With regard to the systematic development and analysis of system models, interdisciplinary computer aided methodologies are becoming more and more important. A graphical description formalism particularly suited for multidisciplinary systems are bond graphs devised by Professor Henry Paynter in as early as 1959 at the Massachusetts Institute of Technology (MIT) in Cambridge, Massachusetts, USA and in use since then all over the world. This monograph is devoted exclusively to the bond graph methodology. It gives a comprehensive, in-depth, state-of-the-art presentation including recent results scattered over research articles and dissertations and research contributions by the author to a number of topics. The book systematically covers the fundamentals of developing bond graphs and deriving mathematical models from them, the recent developments in methodology, symbolic and numerical processing of mathematical models derived from bond graphs. Additionally it discusses modern modelling languages, the paradigm of object-oriented modelling, modern software that can be used for building and for processing of bond graph models, and provides a chapter with small case studies illustrating various applications of the methodology.

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