

Preface

In the last 30 years, differential-algebraic equations have become a widely accepted tool for the modeling and simulation of constrained dynamical systems in numerous applications, such as mechanical multibody systems, electrical circuit simulation, chemical engineering, control theory, fluid dynamics, and many other areas.

Although there has been a tremendous explosion in the research literature in the area of differential-algebraic equations, there are only very few monographs and essentially no textbooks devoted to this subject. This is mostly due to the fact that the research in this area is still very active and some of the major issues were still under development. This concerns the analysis as well as the numerical solution of such problems and in particular the modeling with differential-algebraic equations in various applications.

At this time, however, we feel that both theory and numerical methods have reached a stage of maturity that should be presented in a regular textbook. In particular, we provide a systematic and detailed analysis of initial and boundary value problems for differential-algebraic equations. We also discuss numerical methods and software for the solution of these problems. This includes linear and nonlinear problems, over- and underdetermined problems as well as control problems, and problems with structure.

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