

Preface

We assume that differential-algebraic equations (DAEs) and their more abstract versions in infinite-dimensional spaces comprise *great potential for future mathematical modeling*. To an increasingly large extent, in applications, DAEs are automatically generated, often by coupling various subsystems with large dimensions, but *without manifested mathematically useful structures*. Providing tools to uncover and to monitor mathematical DAE structures is one of the current challenges. What is needed are criteria in terms of the original data of the given DAE. The projector based DAE analysis presented in this monograph is intended to address these questions.

We have been working on our theory of DAEs for quite some time. This theory has now achieved a certain maturity. Accordingly, it is time to record these developments in one coherent account. From the very beginning we were in the fortunate position to communicate with colleagues from all over the world, advancing different views on the topic, starting with Linda R. Petzold, Stephen L. Campbell, Werner C. Rheinboldt, Yuri E. Boyarintsev, Ernst Hairer, John C. Butcher and many others not mentioned here up to John D. Pryce, Ned Nedialkov, Andreas Griewank. We thank all of them for stimulating discussions.

For years, all of us have taught courses, held seminars, supervised diploma students and PhD students, and gained fruitful feedback, which has promoted the progress of our theory. We are indebted to all involved students and colleagues, most notably the PhD students.

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