

Preface of second edition

The analysis and numerical solution of differential-algebraic equations is still an active area of research. Since the publication of the first edition in 2006, the field has developed steadily in various directions. The present second edition therefore constitutes not only a revision of the first edition but a substantial extension covering topics as optimal control, stability theory, and symmetries. In more detail, the second edition differs from the first edition as follows.

Reworked sections.

- Section 2.5 on control for time-invariant linear DAEs has been extended.
- Section 3.3 has been reorganized with regularity as central notion.
- The presentation in Sections 6.1 and 6.2 on numerical index reduction has been improved.
- The old version of Chapter 8 has been omitted.

New sections.

- New sections on optimal control have been added in Chapters 2, 3, and 4.
- Section 3.8 on formal adjoints of differential-algebraic operators and formal necessary conditions for optimal control problems has been included.
- New sections on stability analysis have been added in Chapters 2, 3, and 4.
- New sections on differential-algebraic equations with additional symmetries have been added in Chapters 2 and 3.
- New sections on the stability of discretizations, see Section 5.4, and on stabilization techniques, see Section 6.5, have been included.
- The numerical treatment of the boundary-value problems arising in optimal control is discussed in the new Section 7.4.
- A new Chapter 8 covers further selected topics on overdetermined systems, see Section 8.1, root finding, see Section 8.2, numerical pathfollowing, see Section 8.3, hybrid systems, see Section 8.4, and dissipative Hamiltonian systems, see Section 8.5.

At this point, we would like to commemorate Steve Campbell for his inspiring contributions to the field of differential-algebraic equations and for many years of fruitful collaboration.