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Nodal Analysis. MNA; 2.4 Branch-Oriented Models, Tree-Based Formulations and Hybrid Analysis; Tree-Based Models; Hybrid Analysis; 2.5 Multiport Model and Hessenberg Form; 2.6 Loop Analysis; 2.7 DAE Form of the Models; 3 The Index of DAE Circuit Models; 3.1 On the Index Notion; The Tractability Index; Other Index Notions Solvability3.2 Nodal Models; 3.2.1 Passive Problems; 3.2.2 Low Index Configurations in the Non-passive Context; 3.3 Branch-Oriented and Hybrid Models; 3.3.1 Branch-Oriented Models; 3.3.2 Hybrid Models of Passive Circuits; 3.3.3 Hybrid Models of Non-passive Circuits; 3.4 Example; MNA; Hybrid Analysis; 4 Memristors and Mem-Devices; 4.1 Memristors; 4.2 Memcapacitors, Meminductors and Higher Order Devices; 4.3 DAE Models of Circuits with Mem-Devices; 5 Dynamical Aspects; 5.1 The State Formulation Problem; 5.2 Singularities and Impasse Phenomena; 5.3 Qualitative Properties in the Semistate Context

6 Other Topics in DAE-Based Circuit ModellingModel Reduction; Coupled Problems; Numerics in Circuit Simulation via DAE Models; Other Topics; 7 Concluding Remarks; References; Solution Concepts for Linear DAEs: A Survey; 1 Introduction; 2 Classical Solutions; 2.1 The Kronecker and Weierstraß Canonical Forms; 2.2 Solution Formulas Based on the Wong Sequences: General Case; 2.3 Existence and Uniqueness of Solutions with Respect to In- and Outputs; 2.4 Solution Formulas Based on the Wong Sequences: Regular Case; 2.5 The Drazin Inverse Solution Formula; 2.6 Time-Varying DAEs

3 Inconsistent Initial Values and Distributional Solutions

Sommario/riassunto	The need for a rigorous mathematical theory for Differential-Algebraic Equations (DAEs) has its roots in the widespread applications of controlled dynamical systems, especially in mechanical and electrical engineering. Due to the strong relation to (ordinary) differential equations, the literature for DAEs mainly started out from introductory textbooks. As such, the present monograph is new in the sense that it comprises survey articles on various fields of DAEs, providing reviews, presentations of the current state of research and new concepts in - Controllability for linear DAEs - Port-Hamiltonian differential-algebraic systems - Robustness of DAEs - Solution concepts for DAEs - DAEs in circuit modeling. The results in the individual chapters are presented in an accessible style, making this book suitable not only for active researchers but also for graduate students (with a good knowledge of the basic principles of DAEs) for self-study.