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Topological analysis of qualitative features in electrical circuit theory

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Several qualitative properties of equilibria in electrical circuits are analyzed in this paper. Specifically, non-singularity, hyperbolicity, and asymptotic stability are addressed in terms of the circuit topology, which is captured through the use of Modified Nodal Analysis (MNA) models. The differential-algebraic or semistate nature of these models drives the analysis of the spectrum to a matrix pencil setting, and puts the results beyond the ones already known for state-space models, unfeasible in many actual problems. The topological conditions arising in this qualitative study are proved independent of those supporting the index, and therefore they apply to both index-1 and index-2 configurations. The analysis combines results coming from graph theory, matrix analysis, matrix pencil theory, and Lyapunov theory for DAEs. The study is restricted to problems with independent sources; qualitative properties of circuits including controlled sources are the focus of future research.

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Circuit. n Collection of devices such as sources and resistors in which terminals are connected together by conducting wires. n These wires converge in NODES n The devices are called BRANCHES of the circuit. Circuit Analysis Problem: To find all currents and voltages in the branches of the circuit when the intensities of the sources are known. Prof. C.K. Tse: Basic Circuit Analysis. The topology of an electronic circuit is the form taken by the network of interconnections of the circuit components. Different specific values or ratings of the components are regarded as being the same topology. Topology is not concerned with the physical layout of components in a circuit, nor with their positions on a circuit diagram; similarly to the mathematic concept of topology, it is only concerned with what connections exist between the components. There may be numerous physical layouts and Electric Circuit Analysis - Free ebook download as PDF File (.pdf), Text File (.txt) or read book online for free. These efforts include the development, research, and testing of the theories and programs to determine their effectiveness. The author and publisher make no warranty of any kind, expressed or implied, with regard to these programs or the documentation contained in this book. An electric circuit, or electric network, is a collection of electrical elements interconnected in some way. Later we shall define the electrical elements in a formal manner, but for the present we shall be content to represent a general two-terminal element as shown in Fig. 1.1. The terminals a and b are accessible for connection with other elements.