BOOK REVIEW – ОБЗОР КНИГ

PAUL STEPIAN: *Mathematical Foundations of Network Analysis.* — Springer Tracts in Natural Philosophy, Volume 16. Springer Verlag, Berlin — Heidelberg — New York, 1968. pp. 195.

The book is a development of the most important result of resistive network analysis. Its development is based upon the axioms of Ohm's Law, Kirchhoff's Voltage Law and Kirchhoff's Current Law. The network analysis is based upon a sound mathematical structure. The writer introduces an elaborate mathematical structure, concepts of graph theory, linear algebra and one dimensional algebraic topology to precisely state the mentioned axiomes and use them in the development of the network analysis.

The most interesting objects of network analysis are the branch voltages and branch currents so the effect of the topological properties of these networks are also introduced.

The content of the book is limited to resistive network but the writer's intention is the extension of the results of this book to the field of network synthesis. The developed new methods of network analysis may clarify certain areas of network synthesis.

The first chapter describes the fundamental properties of networks. At first these properties are examined independently of circuit theory considerations. The complications of circuit theory are introduced to the existing elementary structures after a firm establishment of the elementary machinery.

Two particular types of connected sets of branches, loops and trees are described in the second chapter. This chapter deals with cut sets as well.

The third chapter determines the direction of a branch of a network. This conception is accomplished by means of an incidence function and incidence matrix of a set of branches. The third chapter deals with the description of such incidence matrices.

After the interpretation of elementary network theory the fourth chapter deals with introduction of the linear algebra, because electric circuit theory is a combination of network theory and linear algebra.

The concept of boundary operator and coboundary operator is introduced in the fifth chapter. Here the circuit theory is precisely developed too.

Electrical circuit theory can be developed only upon a firm foundation, therefore the sixth chapter gives the precise formulation of the three main laws, namely Ohm's Law, Kirchhoff's Current Law and Kirchhoff's Voltage Law. These formulations are described by the previously introduced mathematical abstractions.

The seventh chapter concludes the investigation of network variables. Formulas are developed for the current chain and voltage chain.

The eighth chapter gives suitable formulas for specific calculation of the branch currents and branch voltages. These formulas prove to be essentially unaffected by changes in the orientation of the network branches.

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