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Book review

The Theory of Similarity and Simulation (with applications to problems in electrical power engineering), by V. A. Venikov, 1969; 494 pages. (*MacDonald & Co.*, £10)

The increasing use of the concept of mathematical modelling by theoretical control engineers as well as the development of analogue computer and simulation techniques by the experimentalist make the publication of this book very timely. First appearing in Russian from Moscow in 1966, it has been translated and put into excellent English by Dr. F. J. Evans of Queen Mary College, who is an authority in control and computation himself.

The author, a member of the USSR Academy of Science, originally worked at the Electrical Engineering Institute at Leningrad and is now at the Moscow Institute of Electrical Power. Much of his book stems from his lecture notes and research work. It is the first major treatise (a quarter of a million words) to appear on this topic.

A thorough discourse on the relationship between theory and experiment forms the introduction. The pattern is set by the masterful way the author defines the limitations of logic and mathematics for describing the physical world, and puts their usefulness into perspective.

The basic theory of similarity, about 20% of the book, extensively covers the necessary analytical ground work for the rest of the book. Starting with the first similarity theorems for linear systems, it extends the concepts to the second theorem of similarity (or π theorem) covering non-linearity conditions. With copious specific examples to emphasise the generality and power of the similarity criteria, this chapter identifies and deals with the various aspects of model theory from exact identity through integral, functional cybernetic to algorithmic identities.

The role of dimensional analysis in the formation of complete identity relationship receives treatment and is expanded further in the first appendix. It is interesting that the author has considered the importance of the actual system of units to be such that a second appendix on SI units is included.

The chapter on similarity criteria for electrical phenomena splits into two parts, a consideration of the general problem for complete electromagnetic similarity and the simpler incomplete form for the study of lumped and distributed parameter electric circuits. Two further chapters on electrical power systems and on physical simulation (i.e. working models, resistance networks and analogue simulations) are intended as a guide to the application of the theory.

The last chapter on mathematical modelling is probably the one of greatest interest to control engineers and computer scientists. From an almost philosophical beginning the theme develops into the use of mathematics, numerical analysis, digital computers and digital differential analysers. Some attention is paid to the statistical side of modelling using random processes with correlation techniques as the identity criteria.

Four other appendices follow the two already mentioned. The book is completed with an extensive, almost largely Russian, bibliography which, although one might wish for more references from other countries, gives source material not previously known in the West.

Although the book is a treatise it can be read by final year and immediate postgraduate student. It will be useful and of interest to all who design or analyse systems.

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