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Finite orthogonal series in the design of digital devices, by M. G. Karpovsky, John Wiley and Sons, New York, 1976, 251 pp., $35.00 with bibliography and subject index.

The subject of this book is an interesting mathematical approach to the design of digital logic, with the intended application of the results to be used in the design of digital computers. The central problem of the book concerns the methodology for designing networks that realize arbitrary boolean functions. In the most elementary case, the problem is to realize a single boolean valued function $f(x_1, x_2, \ldots, x_n)$ of the n boolean variables $x_1, x_2, \ldots, x_n$. The design objective is to obtain minimum cost designs where cost is measured in terms of the costs of the primitive functions used to construct the given function. More complex problems derived from the basic one include the design of networks that realize two or more boolean functions of the same arguments, the design of networks that realize sequential functions (functions of present and past values of arguments), and the design of networks for partially specified functions. In the latter case the design makes use of the freedom to complete the function specification arbitrarily, and picks a completion that achieves minimal cost. Yet another problem is the design of networks that exhibit error-correction properties in that failures of such a network result in a network that produces a different function from the desired one with low probability.

Traditional approaches taken by practitioners involve costly searches over many possible implementations to find the best one, or they rely on canonical realizations that are improved by hand on an *ad hoc* basis. Karpovsky exposes a very different mathematical viewpoint to the minimization process that has several interesting properties. His work is partially stimulated by work by Ninomiya and by Lechner on harmonic analysis of boolean functions.