book's Fig. 1.1, which naively shows a single horizontal line illustrating the concept of steady-state power. On the whole, however, this book's real messages are in its equations and their lucid discussions.

To sum up, this monograph would be recommended for the serious researcher in random processes, especially if he is more theoretically than experimentally oriented. Thus, *Random Processes in Nuclear Reactors* might be explicitly titled *A Comprehensive Review of Historically Accepted Theoretical Methods in Both Zero Power and Power Reactor Noise.* In the laboratory or in the power plant where interests are more concrete than this book intends, it would probably accumulate dust. But well written in the style of the university academician, it will appropriately find a place on the bookshelves of many scholars, even those who are more interested in stochastic methods *per se* than in reactors.

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About the Reviewer: Joseph A. Thie is an independent consultant to the reactor industry. He is presently engaged primarily in areas of safety, design, instrumentation/ control, and testing. Among Dr. Thie's publications are many papers treating random fluctuations, including those presented at several international conferences, and his book, Reactor Noise. *Other books that he has authored or coauthored are* Heavy Water Exponential Experiments Using ThO_2 and UO_2, Nuclear Reactor Instrumentation Systems, *and* The Technology of Nuclear Reactor Safety.

A Rational Finite Element Basis. By E. L. Wachspress. Academic Press, New York (1975).

Gene Wachspress is well known in the nuclear engineering community, and his book *Iterative Solution of Elliptic Systems and Applications to the Neutron Diffusion Equations of Reactor Physics* will remain a basic reference for anyone working in the field of numerical reactor calculations. The scope of *A Rational Finite Element Basis* is quite different: As the author states in his concluding remarks, it is a research monograph, and no attempt is made to support the theory by extensive numerical calculations. In this reviewer's opinion, it is indeed a very fine piece of research, at least through its first eight chapters, which are not applications oriented. In brief, the author develops a finite element basis that applies to elements of arbitrary geometry in real coordinates, thus providing an alternative to the current isoparametric approach. The basis functions described are in general ratios of polynomials, but reduce to well-known and widely used polynomial functions when, for example, in two dimensions, triangles and parallelograms are considered. These rational basis functions are constructed in a logical manner with an increasing degree of sophistication and carefully selected examples, which support the progression and make it appear quite natural.

In Chap. 1, some notation and several definitions are introduced: "polypols" (closed planar figures bounded by algebraic curves) and, in particular, "polycons" (bounded by segments of lines and conics) are presented as generalizations of polygons (bounded by segments of lines, following the author, who is somewhat disrespectful for etymology). To each element node is associated a "wedge" basis function, and a set of properties are required of these wedges to achieve a C^0 continuous, first-degree, patchwork approximation over a collection of polypols. Except in Chap. 8, only "well-set" polypols are considered, i.e., polypols in which the boundary curves intersect transversally at the vertices and in which their extensions do not intersect the polypol (a generalization of convex quadrilaterals). In Chap. 2, the inadequacy of polynomials as quadrilateral wedges is demonstrated, and rational functions that satisfy the requirements of Chap. 1 are built up. In Chap. 3, similar concepts are applied to selected polycons: The analysis developed for quadrilaterals is extended to curved sides, and a qualitative description of the basis functions is given, while the precise construction recipe is deferred to Chap. 5. Chapter 4 is concerned with the algebraic geometry foundations necessary to generalize the previous analysis to more complex situations (polypols, higher-degree approximation, or higher-dimensional elements). Some new terms are introduced, and several key theorems are stated without proof, the reader being referred for the details to pertinent texts. The construction of rational wedges for polycons and polypols is then revised in Chap. 5 in a much more precise algebraic geometric setting. The generalization to polypols turns out to be more difficult; in particular, a general proof of regularity of the wedges functions is not given, but the construction appears to be reasonably well founded and fairly general. The next two chapters are devoted to generalizations to higher-degree approximations, and in three dimensions, while Chap. 8 treats the case of "ill-set" polypols, that is, polypols that, like nonconvex quadrilaterals, are not well set. The reader who leaves the book after these eight chapters would almost certainly remain quite impressed by the broad area of research covered in such a logical and progressive way. To go through some of the details, he will need paper and a sharp pencil, but fortunately quite a lot of well-chosen figures are provided that back up the text admirably and help very much in the understanding of what the author means.

The last two chapters of the book are applications oriented and, in this reviewer's opinion, are somewhat weaker than the rest of the book. In Chap. 9, the author, who clearly wants to "sell" his basis functions, faces in earnest the problem of achieving an actual discretization and, in particular, of evaluating various integrals over the elements, integrals of products of the basis functions and of their first derivatives. With rational functions, this turns out to be a nontrivial problem that is solved here by looking back at more familiar elements. Indeed, polypols are partitioned into triangles and segments, and the integrals are estimated by combining the contributions of the various components. For triangles, well-known quadrature formulas are available. For segments, such formulas are not as easily obtained, and the approach followed here consists in introducing isoparametric segments and using the corresponding quadrature formulas. In other words, one goes back partly to classical elements, and one could wonder whether it would not have been easier to achieve such a partition into triangles and isoparametric segments right from the beginning and to use the corresponding familiar polynomial or isoparametric functions, for which the approximation properties and the effect of numerical quadrature errors are theoretically well founded. Instead, several finite element discretizations are proposed by the author to approximate rational wedge integrals. In sharp contrast with the first part of the book, the approach here remains essentially qualitative, and no attempt is made at a rigorous approximation theory. Practical guidelines are offered that often lack a firm theoretical basis, and if some insight is undoubtedly gained, the reader is left with the feeling that something is missing. Perhaps all that is needed are just a few simple but well-chosen numerical examples, which, had they been given, would have eventually been convincing and impressive, as they were in Wachspress' first book. Finally, the last chapter is no more than a last (and quite brief) attempt to justify the practical interest of rational finite elements. Two computational techniques, namely synthesis and coarse mesh rebalancing, which are of current concern in numerical reactor calculation, are sketched, and Wachspress suggests that his rational basis would provide them with a flexibility that is lacking and that would broaden their scope and enhance their effectiveness.

In spite of all the doubts that will probably assail the reader about the practical necessity and utility of rational basis functions, the book is certainly worth reading, at least by the finite elements enthusiasts, were it only for the remarkable unifying view it provides of finite element basis functions. Although it was published in an Academic Press rapid manuscript reproduction series, the typographical errors are practically nonexistent, except perhaps in the first chapter, and the printing is quite pleasing to the eye.

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