modelling of thin domains and approximation of the plate and shell models that arise. An extended discussion of the locking phenomenon is given. The book concludes with two short appendixes on Sobolev spaces, Hilbert space interpolation, and orthogonal polynomials.

The book complements other texts in the area [1, 2] that are at a more elementary level and focus more on the practical implementation aspects. The manuscript is based on graduate lectures presented by the author to an audience of engineers and mathematicians at the ETH Zürich. In principle, the inclusion of background material means that the book should be accessible to a graduate student with quite a modest background in numerical analysis of elliptic partial differential equations. However, the demanding pace of the text would leave many UK graduate students in mathematics trailing in its wake. Exercises are included in the text, ranging from trivial computations to deeper applications of the theory.

My only real criticism of the book lies in the number of minor typographical errors and inconsistencies that should have easily been detected by a copy editor. At a cost of $85.00 for 374 pages, I would expect the publisher to produce a far more polished product. Nevertheless, this is a detailed and authoritative account of the theory of *hp*-version finite element methods at the end of the 1990s, and provides a much needed reference source for theoreticians in this area.

References

[1] B. Szabó and I. Babuška, *Finite Element Analysis*, John Wiley and Sons, Inc., 1991.
[2] G. Em. Karniadakis and S. Sherwin, *Spectral/hp Element Methods for CFD*, Oxford University Press, 1999.

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3[41A10, 42A10, 65M70, 65T10]—*Spectral methods in Matlab*, by Lloyd N. Trefethen, SIAM, Philadelphia, PA, 2000, xvi+165 pp., 23 1/2 cm, softcover, $36.00

This book is published within the series "Software, Environments, Tools"; in other words it is meant to be a "cookbook" for someone who is curious about learning spectral methods but does not want to go through a more comprehensive spectral method book or course, at least not at the beginning. It builds on the powerful Matlab platform and brings the essentials of spectral collacation methods with just forty short Matlab "M-files". These Matlab codes will also generate intriguing graphics to vividly illustrate the numerical results.

Spectral methods have been under rapid development in the last twenty-five years. There are many books written in this period, most notably the pioneering book by Gottlieb and Orszag in 1977 and the comprehensive book by Canuto, Hussaini, Quarteroni and Zang in 1988. The book under review is different from these comprehensive books. Although it does explain the essential background of spectral methods, in order to give the readers the basic ideas before letting them play with the Matlab codes, the emphasis here is clearly not on a comprehensive coverage of spectral method but on a practical and rapid introduction to the readers of how the spectral method works through the Matlab codes. The advantage of this approach is that many more students and researchers are expected to learn the basics of the spectral methods through this book and the Matlab codes in it. Perhaps some of them will get so interested in the method that they will ask deeper questions which this book cannot answer, but then they will already be adequately prepared to move on to read a more comprehensive spectral method book.

There are fourteen chapters in the book. The first six chapters cover the basic topics in spectral methods, such as the differentiation matrices and fast Fourier transforms. Chapters 7 through 14 give more applications. A reader who cares less about the underlying ideas of the spectral method but more about the applications could probably skip the first six chapters. However, it would be much more effective if one went through all the chapters and played with the Matlab codes as soon as they appear in the book.

This book is a very nice addition to the collection of books on spectral methods, from a totally different angle. It should attract more students and researchers to the powerful spectral methods.

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4[65-02, 65N06, 65N30]—*Generalized difference methods for differential equations. Numerical analysis of finite volume methods*, by Ronghua Li, Zhongying Chen, and Wei Wu, Marcel Dekker, New York, NY, 2000, xv+442 pp., 23 1/2 cm, hardcover, \$175.00

This book provides a framework for construction and analysis of finite volume approximations of partial differential equations. The approach falls into the general class of Petrov–Galerkin methods that presents the boundary value problem in a weak form with the corresponding bilinear form defined over two different spaces: the solution space and the test space. In the book, the approximate solution is taken in the finite element space of piecewise polynomial functions over a partition of the domain into simplices or quadrilaterals (in most of the cases these are conforming spaces), while the test space consists of piecewise constant functions over a different (a dual) partition of the domain. Integrating a convection-diffusion-reaction equation over a particular finite volume produces a balance equation, which is the sum of surface (line) integrals of the diffusive and convective flux through the volume boundary and volume integrals of the reaction and the source terms. Replacing the derivatives in the balance equation by finite differences has been successfully used in the last 50 years. Alternatively, one can replace the exact solution by its finite element interpolant. This approach, consistently used in the book, is often called finite volume element method, a term that describes quite accurately its essence. The finite volume method and its applications to problems in science and engineering has been a major direction in computational mathematics in the last fifteen years (see, e.g., the Proceedings of the First and Second International Conferences on Finite Volumes for Complex Applications [5, 6]).

In the book the finite volume element approach is applied to second and fourth order elliptic equations, to parabolic and hyperbolic equations as well as convection-dominated diffusion problems, elasticity and Maxwell's equations. A merit of the book is that it gives a general framework for presenting this approach in a unified