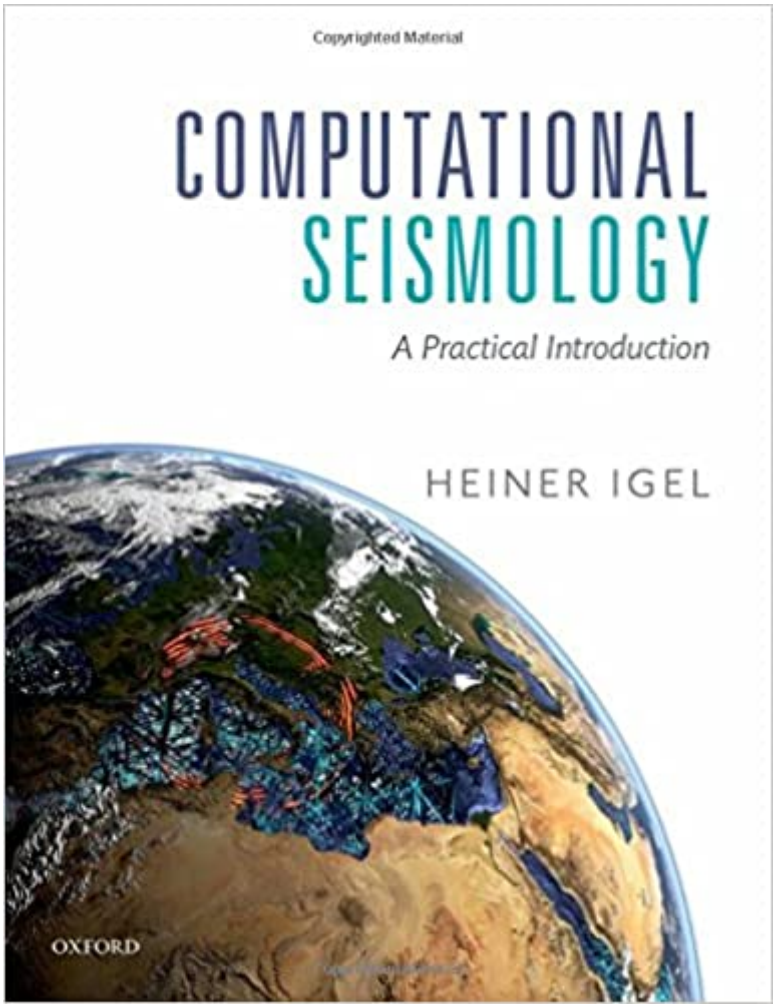
Computational Seismology: A Practical Introduction



Synopsis

This book is an introductory text to a range of numerical methods used today to simulate time-dependent processes in Earth science, physics, engineering, and many other fields. The physical problem of elastic wave propagation in 1D serves as a model system with which the various numerical methods are introduced and compared. The theoretical background is presented with substantial graphical material supporting the concepts. The results can be reproduced with the supplementary electronic material provided as python codes embedded in Jupyter notebooks. The book starts with a primer on the physics of elastic wave propagation, and a chapter on the fundamentals of parallel programming, computational grids, mesh generation, and hardware models. The core of the book is the presentation of numerical solutions of the wave equation with six different methods: 1) the finite-difference method; 2) the pseudospectral method (Fourier and Chebyshev); 3) the linear finite-element method; 4) the spectral-element method; 5) the finite-volume method; and 6) the discontinuous Galerkin method. Each chapter contains comprehension questions, theoretical, and programming exercises. The book closes with a discussion of domains of application and criteria for the choice of a specific numerical method, and the presentation of current challenges.Readers are welcome to visit the author's website www.geophysik.lmu.de/Members/igel for more information on his research, projects, publications, and other activities.

Book Information

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Customer Reviews

"This book has been missing for years and will become an important asset for a broad readership of both students and practitioners in applied and theoretical geophysics. With insightful illustrations, code, practical examples and exercises, the reader will gain insight into the fundamental critical aspects of the wide range of methods used for solving seismic wave equations and problems in its many different disguises." --Johan Robertsson, Institute of Geophysics, ETH-Zurich, Switzerland"This essential book heralds the era of computational seismology. Any student of modern seismology should master its fundamental knowledge. Fortunately for them, the author makes this easy via this highly readable and educational book full of well-chosen examples and exercises." --Jeroen Tromp, Princeton University, USA"Heiner Igel provides a broad survey of methods for calculating seismograms, contrasting the benefits and limitations of techniques through applications in 1-D, with indications of how extensions can be made to 3-D. The examples are well chosen and enable students to get a feel for computational procedures and hence understand the more complex packages they may encounter later. The book is to be highly recommended to both those starting in seismology and more established workers who wish to gain a broader understanding of the computational scene." --Professor Brian L. N. Kennet, The Australian National University"Heiner Igel's book fills an empty slot between books devoted to numerical algorithms and books more oriented to seismological topics. It has arrived at the right moment. Igel overcomes the difficulty of describing methods in a comprehensive way for students and researchers trained in seismology and Earth sciences disciplines while keeping the necessary specific ingredients of these approaches from the point of view of computer sciences. Applications to different seismological targets and future challenges, as well as a clear vision of the need of collaborative scientific interaction imbedded into the modern effort for sharing computer codes, makes this book a highly recommended one for anyone who wants to start or to improve his/her competence in quantifying seismic wave propagation." --Jean Virieux, Institut des Sciences de la Terre ISTerre, France"This valuable book provides a highly recommended platform for a new generation of seismologists and those of the older generation who are retraining. Very readable, it covers the classes of discrete methods in a balanced and appropriately detailed way, with pointers to texts on more traditional methods of seismic modelling as well as further reading on the new, more general and computationally intensive numerical methods, including code links." --Colin Thomson, Schlumberger Cambridge Research, UK

Heiner Igel, Professor of Seismology, Department of Earth and Enivronmental Sciences, Ludwig Maximilian University of Munich, GermanyHeiner Igel studied geophysics in Karlsruhe and

Edinburgh. He obtained his doctoral degree in 1993 from the Institut de Physique du Globe in Paris developing parallel forward and inverse modelling tools for wave propagation problems. He then moved to the Institute of Theoretical Geophysics in Cambridge, UK, where he worked on wave simulation techniques for regional and global seismic wave propagation. In 1999 he became Professor of Seismology at the Ludwig-Maximilians-University Munich. His current interests include full-waveform inversion, high-performance computing, and rotational ground motions. He is a member of the German National Academy of Sciences.

Just got the book, so my comment and 4 stars are based on my first impression of it from a quick read over the past few days. So far I am very glad and well impressed with the book. It has a nice page layout and is well organized and designed such that chapters can be read independently, which is really useful in case one wants to use the book as a reference. In fact, the main reason for liking this book is that it is a treasure trove of references about the many methods to simulate seismic wavefields. In short, this book offers such a comprehensive and yet very readable introduction to .this vast and complex field. I am sure that a lot people both in the industry and in the academia will profit from it .

my sister, This bread product is by far the best bread product I have ever owned! As a former Chef, kitchen tools are very important to me. I have an extensive collection of products and am always looking for the best tools. This is not only an excellent bread product, at a good price but a beautiful design and feels great in my hand. It is sharp and effective. I am so happy with it I bought two and have put it on my gift giving list for years to come. If you enjoy great kitchen tools this product should not be missed! good . this price is valuable. just fine,

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