Reviews

Coordinated by Sven Treitel

On Foundations of Seismology, by James R. Brown and M. A. Slawinski, ISBN 978-981-4329-49-1, 2017, World Scientific, 184 p., US$88 (print), US$70 (eBook).

James R. Brown is a professor of philosophy at the University of Toronto, and Michael A. Slawinski is a professor of seismology and the director of The Geomechanics Project at Memorial University at St. John's, Newfoundland. Both have published on the philosophy of science and mathematics. This book could have been titled, "On the Philosophy of Seismology and Other Matters." They discuss the philosophical underpinning of seismology, using as its basis continuum mechanics. The authors state: "The continuum used to model seismic phenomena is an abstract entity that has properties similar to physical bodies. It has mass, and transmits energy and momentum." In the preface they state: "However, it is neither a historical treatise of seismology nor a textbook to study its techniques, but a discussion of it foundations in which we examine the conceptual structure of the theory."

One scientific result discussed is the discovery of the earth's inner core from both seismology and tidal studies. The conceptual structure of seismology is continuum mechanics; however, the scientific method and other related works are discussed, and at times they drift off of seismology and into these other subjects. Other aspects of science and mathematics are also discussed in their realm of philosophy with input from many philosophers both ancient (Plato, Aristotle, and Voltaire) and modern (Penrose, Kuhn, and Truesdell).

This is a philosophical treatise and would be of interest to those with knowledge of the rudiments and vocabulary of philosophy since this is to whom the authors are writing. It may be difficult for a geophysicist to gather any practical knowledge but it may provide a philosophical and/or scientific underpinning to their applied research. Written in an almost conversational manner, it could be read by someone with a moderate scientific background; the volume is reasonably easy to follow, especially if you can read the road signs and some French.

There are 20 or so black-and-white cartoonish sketches, which lighten the text to some extent. Obviously this book is not for everyone but for some it could be an epiphany. On the negative side, I felt that the dialogue tended to drift and occasionally gets off the main theme, and I did not sense a clear beginning, middle, and end; this might be the style for a philosophical volume.

Within the seven-page list of references, there are some traditional seismological ones, e.g., Aki and Richards (2002), Backus (1962), Dziewonski and Anderson (1981), Kennett and Bunge (2008), and others. Among those acknowledged are Klaus Helbig and Albert Tarantola. So the core science of seismology is represented.

I must confess, this is the most difficult book that I have reviewed, but if you can stay with it, you may find an avenue never traveled before that is of great interest and insight. Its literary equivalent would be the end of *The Great Gatsby*.

— Patrick Taylor
Greenbelt, Maryland

Waves and Rays in Elastic Continua, by Michael A. Slawinski, ISBN 978-981-4641-75-3, 2015, World Scientific, 656 p., US$138 (print).

The subjects covered by *Waves and Rays in Elastic Continua* span theoretical seismology, applied mathematics, and physics. The book presents both theoretical backgrounds and modern achievements in these branches of science. The sheer scope makes this book a massive work, consisting of more than 600 pages. The main part of the book is divided into three logical sections: "Elastic continua," "Waves and rays," and "Variational formulation of rays." These sections are partially connected through definitions and proofs, but can be studied individually as each of them could easily be published as an individual book. From a geophysical point of view, I found the first two parts most useful for teaching and research, while the last and shortest one is a bit too focused on mathematical elegance at the expense of the clear explanations of the problems, which are typical of the first two parts.

The mathematical background required to follow the covered subjects is limited to the level of undergraduate science studies including linear algebra, differential and integral calculus, differential equations, and basic elements of vector and tensor calculus. Throughout the book, the mathematical reasoning, which is classical in form, is very consistent and easy to follow, even when complicated problems are being explained. This is probably the strongest point of this book and makes it an excellent textbook for courses of theoretical geophysics and similar disciplines. Additionally, in every section the historical and even the philosophical context is provided together with auxiliary readings. Reading even a small part of the book can act as an entry point for more in-depth study, so not only students but also scientists and professional geophysicists should find it interesting.

The book can be read from beginning to end, but because of its consistency and rigorous mathematical notations, individual chapters can be easily studied independently. This is especially true of part 2 of the book, titled "Waves and rays," which is a real pleasure to read. Every single chapter in this part is an independent, well-written, and in-depth lecture on its own subject. This clear separation makes looking for particular information almost as convenient as in a handbook.

This is the third edition of the book (please note that the original title was *Waves and Rays in Elastic Media*). It includes significant modifications and additions to the original. These changes and the information about modern achievements make it one of the most up-to-date textbooks in theoretical geophysics. The editing of this edition is perfect throughout, but there are some unfortunate typographical mistakes on the back cover that were missed by the publisher.

To conclude, I can strongly recommend this well-written, in-depth, and modern discourse on some of the most important theoretical aspects of seismology.

— Tomasz Danek