*Book review: Moczo, P., Kristek, J. & Galis, M. 2014. The finite-difference modelling of earthquake motions: waves and ruptures, Cambridge University Press.*.

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Although numerical methods have a sound mathematical basis there is also a bit of creativity involved; the finite-difference method is no exception. This book provides a good review of the mathematical foundations for the various numerical implementations, but it also does not shy away from discussing the many creative solutions often needed to make these algorithms tractable and efficient. This book is focused primarily on modelling earthquake ruptures and seismic waves, however, it will have utility for any seismologist interested and/or involved with seismic wave propagation problems.

The finite-difference method applied to seismic problems has been around for over 50 years and as such there is a significant database of peer-reviewed papers. However, this book is one of only a few that provides a consistent and compact treatise of the finite-difference method for seismic wave propagation problem. Most books that I have come across are actually a collection of peer-reviewed papers (i.e., monograph) and, although they do provide a comprehensive collection of the state-or-the-art research, they lack a coherent voice and theme.

This book is divided into four parts. Part 1 gives a review of the elastic wave equation, viscoelasticity and earthquake source mechanism. Part 2 presents the finite-difference method for both the one-dimensional and three-dimensional case, describing the more popular formulations and numerical implementations, with sufficient detail about boundary conditions. In part 3, the authors move beyond strictly the finite-difference method and provide some discussion on hybrid finite-difference implementations as well as the finite-element method. Finally, in part 4 the authors provide an example of applying the finite-difference method to study real data. Furthermore, the authors discuss the importance of verification and validation of the finite-difference method. As an added bonus, the authors provide access to computer codes via online resources. The codes are fairly easy to install either for single-core or MPI implementation, which could be used as a learning resource and/or for research.

I have some reservations about the book and hopefully this can address in future editions. First, the discussion often presents developments in the various aspects of the finite-difference method in a chronological order and often in significant detail. However, after awhile this becomes a distraction from the main point of discussion. It is understandable that the authors wish to provide credit to all bodies of research to be as complete and balanced in their discussion, however often I felt mention of particular papers was not instrumental to the point being made. Second, it would be helpful to have references of key publications at the end of each chapter and/or suggested references. Third, I would suggest that the authors develop some worked examples throughout the book that would enable linking concepts presented within the book to actual algorithms such as within their online computer codes provided. In my experience, learning is certainly enhanced when concepts are applied to a practical problem.

I would certainly buy a hardcopy of this book at £75. In fact, I wish this book had been available while I was working on my PhD thesis. This book will make an extremely useful addition to my current library and will fit nicely between Tannehill et al. (1997) and Fornberg (1998).

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*References:*

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Tannehill, J.C., Anderson, D.A. & Pletcher, R.H. 1997. *Computational Fluid Mechanics and Heat Transfer*, Second Edition. Taylor and Francis, 792 pp.