Seismic Waves and Sources. Ari Ben-Menahem and Sarva Jit Singh. Springer, New York, 1981, xxi + 1108 pp., 307 figs., DM 182.00/approx. US $107.40, Clothbound.

In recent years several excellent books on the subject of theoretical seismology have appeared on the market. This might be seen as an indication that seismology has finally become a full grown branch of physics since its foundations were laid, theoretically and empirically, in the 19th century.

One of these recent books, "Quantitative seismology" by Aki and Richards, appeared in 1980 and has become a standard reference already. The present book "Seismic waves and sources" by Ben-Menahem and Singh appeared in 1981, and it has a somewhat different and more limited scope than that by Aki and Richards.

In the preface the selection of the material included is explained; the authors used two criteria, first only well-established theoretical results were reported, verified by repeated observations and secondly only topics from the mainstream of contemporary seismology were treated. This limitation of the number of subjects made it possible to give a very detailed treatment of the material included. The book contains many examples of detailed analysis of simple symmetric models that can be handled analytically.

Chapter one gives an introduction into continuum mechanics, leading to the equation of motion for the field of a disturbance in an elastic medium. The dyadic notation used throughout the book is introduced here, and treated in more detail in an appendix on the algebra and calculus of dyadics.

In Chapter two on waves in infinite media the separability of the equations of motion in general coordinates is discussed and the eigensolutions are given in coordinate free form in terms of the so-called Hansen vectors. This results in a unified treatment of the different types of vector surface harmonics in use in seismology.

Chapter three is on plane waves in a layered halfspace.

The next chapter (4), entitled "representation of seismic sources", begins with the field of a point source in a homogeneous space. Dipole sources and the source moment tensor are introduced next. The integral relations of Betti Somigliana and Volterra are derived and applied in the introduction of the dislocation theory of seismic sources. The chapter continues with a section on fault plane geometry, giving relations between an multitude of coordinate systems employed in fault descriptions. The section on dipolar sources in a homogeneous medium contains a detailed discussion on the eigenvector expansion of sources. A section on finite moving sources gives an analysis of models of propagating ruptures.

Chapters five and six are on surface wave amplitude theory and the normal-mode solution for spherical earth models.

Chapter seven, entitled "Geometric elastodynamics: rays and generalized rays", deals with raytheory in a broad sense. The chapter starts with an account of

asymptotic raytheory, developed in the 1950's, which forms a firm theoretical basis for geometric raytheory, used since the beginning of the quantitative interpretation of seismological observations early this century.

At this point one might have expected a treatment of asymptotic ray theory for laterally heterogeneous media, since for such media this is probably the most succesful method available. Whereas for laterally homogeneous media there are several useful alternatives for the raytheoretical approach, this is far less the case with laterally heterogeneous media. However, although this is not explicitly mentioned in the introduction, laterally heterogeneous media are not treated in the book.

The equivalence of several asymptotic evaluations of the wavenumber integral, appearing in the analytic expression for the wave field, and the result of geometric raytheory is, illustrated for some simple examples. Using this equivalence a detailed analysis is given for a case where geometric raytheory breaks down, namely on a caustic of the wave field.

The section entitled synthetic seismograms deals entirely with the method known as the Cagniard de Hoop method. It is used to solve Lamb's problem for a homogeneous halfspace, then generalized to multilayered media. The chapter ends with a section comparing normal mode, and ray solutions: The method of normal mode summation is the only alternative for the (generalized) ray method treated extensively.

The relation between rays and normal modes is treated further in the next chapter on the asymptotic theory of the earth's normal modes.

Chapter nine is on atmospheric and waterwaves and companion seismic phenomena. Although this field can hardly be described as belonging to the mainstream of seismology, phenomena like tsunamis and seiches certainly are important to society, in view of the damage and casualties they cause.

Chapter ten deals with wave motion in anelastic media.

The book contains some 100 pages of appendices on various mathematical techniques applied in the main text, which makes the book rather self contained. The book is clearly written, and contains many references to the literature in the bibliographies at the end of each chapter. Unfortunately there are no references within the text to these bibliographies. The choice of subjects in the book is somewhat subjective and the emphasis is fully on the analytical treatment of the material; methods of a more numeric nature, like the reflectivity method, for the calculation of synthetic seismograms are not treated.

This book will certainly become a classic and it should be recommended to anyone involved in seismological research.

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