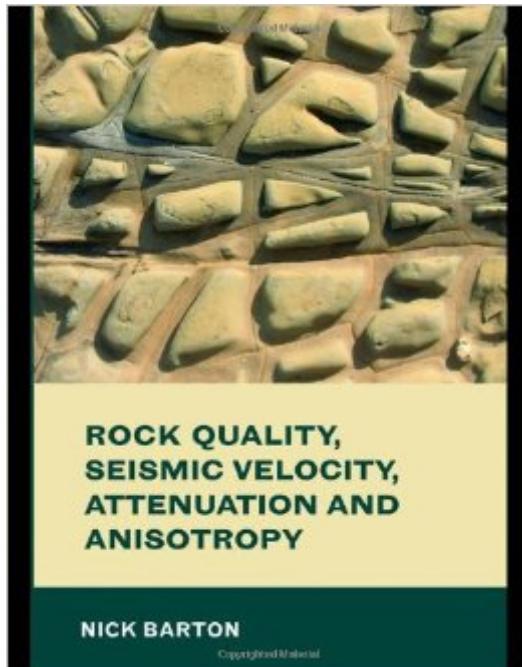


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# Rock Quality, Seismic Velocity, Attenuation And Anisotropy



## Synopsis

Seismic measurements take many forms, and appear to have a universal role in the Earth Sciences. They are the means for most easily and economically interpreting what lies beneath the visible surface. There are huge economic rewards and losses to be made when interpreting the shallow crust or subsurface more, or less accurately, as the case may be. This book describes seismic behaviour at many scales and from numerous fields in geophysics, tectonophysics and rock physics, and from civil, mining and petroleum engineering. Addressing key items for improved understanding of seismic behaviour, it often interprets seismic measurements in rock mechanics terms, with particular attention to the cause of attenuation, its inverse seismic quality, and the anisotropy of fracture compliances and stiffnesses. Reviewed behaviour stretches over ten orders of magnitude, from micro-crack compliance in laboratory tests to cross-continent attenuation. Between these extremes lie seismic investigation of rock joints, boreholes, block tests, dam and bridge foundations, quarry blasting, canal excavations, hydropower and transportation tunnels, machine bored TBM tunnels, sub-sea sediment and mid-ocean ridge measurements, where the emphasis is on velocity-depth-age models. Attenuation of earthquake coda-waves is also treated, including in-well measurements. In the later chapters, there is a general emphasis on deeper, higher stress, larger scale applications of seismic, such as shear-wave splitting for interpreting the attenuation, anisotropy and orientation of permeable 'open' fracture sets in petroleum reservoirs, and the 4D seismic effects of water-flood, oil production and compaction. The dispersive or frequency dependence of most seismic measurements and their dependence on fracture dimensions and fracture density is emphasized. The possibility that shear displacement may be required to explain permeability at depth is quantified. This book is cross-disciplinary, non-mathematical and phenomenological in nature, containing a wealth of figures and a wide review of the literature from many fields in the Earth Sciences. Including a chapter of conclusions and an extensive subject index, it is a unique reference work for professionals, researchers, university teachers and students working in the fields of geophysics, civil, mining and petroleum engineering. It will be particularly relevant to geophysicists, engineering geologists and geologists who are engaged in the interpretation of seismic measurements in rock and petroleum engineering.

## Book Information

Hardcover: 756 pages

Publisher: CRC Press; 1 edition (October 31, 2006)

Language: English

ISBN-10: 0415394414

ISBN-13: 978-0415394413

Product Dimensions: 8.7 x 1.6 x 11.1 inches

Shipping Weight: 5.1 pounds (View shipping rates and policies)

Average Customer Review: 5.0 out of 5 stars (See all reviews) (2 customer reviews)

Best Sellers Rank: #2,663,162 in Books (See Top 100 in Books) #107 in Books > Engineering & Transportation > Engineering > Civil & Environmental > Seismic Design #369 in Books > Science & Math > Earth Sciences > Seismology #531 in Books > Science & Math > Earth Sciences > Earthquakes & Volcanoes

## Customer Reviews

This encyclopedic monograph expresses nearly 40 years of Nick Barton's research interests in engineering classification of rock masses. Rock Quality, Seismic Velocity, Attenuation, and Anisotropy organized into two basic parts: Chapters 1 through 9 in Part I pertain to civil engineering scales and applications, whereas Chapters 10 through 16 in Part II pertain to large-scale seismic phenomena and high pressure laboratory rock physics tests. Figures outnumber equations through Rock Quality, Seismic Velocity, Attenuation, and Anisotropy, and a random examination revealed at least two figures on just about any pair of facing pages. References for all chapters are combined into a single list that is 27 pages long. Conclusions are given for each chapter in numbered paragraphs. The largest number of paragraphs (51) is for Chapter 15 (Shear wave splitting in fractured reservoirs and resulting from earthquakes). The Index is impressive, occupying 64 pages. Rock Quality, Seismic Velocity, Attenuation, and Anisotropy contains so much valuable information that selecting one or two items to serve as examples is a challenge. The introduction to Rock Quality, Seismic Velocity, Attenuation, and Anisotropy includes comments regarding the different problems that civil engineers and engineering geologists face compared to problems that petroleum engineers or tectonophysicists face. Barton notes that it is understandable, but regrettable, that advances in the different areas have been largely unknown outside the boundaries of the technical area. Practitioners and researchers in these major fields participate in separate conferences and read and publish in separate journals. Barton notes that technical language complicates cross-discipline interactions.

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