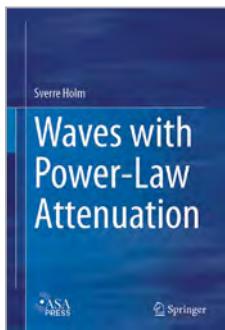


# Waves with Power-Law Attenuation



**Author:** Sverre Holm

**Copyright:** 2019

**Publisher:** Springer International Publishing

**Copyright Holder:** Springer Nature Switzerland AG

**Hardcover:** ISBN 978-3-030-14926-0

**Edition Number:** 1

**Number of Pages:** XXXVII, 312

**Number of Illustrations and Tables:**

60 b/w illustrations, 82 color illustrations

**Topics:** Acoustics

- Couples fractional derivatives and power laws and gives their multiple relaxation process interpretation
- Investigates causes of power law attenuation and dispersion such as interaction with hierarchical models of polymer chains and non-Newtonian viscosity
- Shows how fractional and multiple relaxation models are inherent in the grain shearing and extended Biot descriptions of sediment acoustics
- Contains historical vignettes and side notes about the formulation of some of the concepts discussed

This book integrates concepts from physical acoustics with those from linear viscoelasticity and fractional linear viscoelasticity. Compressional waves and shear waves in applications such as medical ultrasound, elastography, and sediment acoustics often follow power law attenuation and dispersion laws that cannot be described with classical viscous and relaxation models. This is accompanied by temporal power laws rather than the temporal exponential responses of classical models.

The book starts by reformulating the classical models of acoustics in terms of standard models from linear elasticity. Then, non-classical loss models that follow power laws and which are expressed via convolution models and fractional derivatives are covered in depth. In addition, parallels are drawn to electromagnetic waves in complex dielectric media. The book also contains historical vignettes and important side notes about the validity of central questions. While addressed primarily to physicists and engineers working in the field of acoustics, this expert monograph will also be of interest to mathematicians, mathematical physicists, and geophysicists.

## About the Author

Sverre Holm was born in Oslo, Norway, in 1954. He received M.S. and Ph.D. degrees in electrical engineering from the Norwegian Institute of Technology (NTNU), Trondheim in 1978 and 1982, respectively.

He has academic experience from NTNU and Yarmouk University in Jordan (1984–86). Since 1995 he has been a professor of signal processing and acoustic imaging at the University of Oslo. In 2002 he was elected a member of the Norwegian Academy of Technological Sciences.

His industry experience includes GE Vingmed Ultrasound (1990–94), working on digital ultrasound imaging, and Sonitor Technologies (2000–05), where he developed ultrasonic indoor positioning. He is currently involved with several startups in the Oslo area working in the areas of acoustics and ultrasonics.

Dr. Holm has authored or co-authored around 220 publications and holds 12 patents. He has spent sabbaticals at GE Global Research, NY (1998), Institut Langevin, ESPCI, Paris (2008–09), and King's College London (2014). His research interests include medical ultrasound imaging, elastography, modeling of waves in complex media, and ultrasonic positioning.

## ASA Books available through Amazon.com

The ASA Press offers a select group of Acoustical Society of America titles at low member prices on Amazon.com with shipping costs as low as \$3.99 per book. Amazon Prime members can receive two-day delivery and free shipping.

For more information and updates about ASA books on Amazon, please contact the ASA Publications Office at 508-534-8645.