

EM 518 — WAVE PROPAGATION IN ELASTIC SOLIDS

Course References

1. B. A. Auld, *Acoustic Waves and Fields in Solids*, vols. 1 & 2, (Krieger, Malabar, 1990) [library reserve]. This set of two volumes is a comprehensive work dealing with all aspects of wave propagation, generation, and detection. All types of media are treated here: isotropic, anisotropic, piezoelectric. The treatment level is quite high. All types of guided waves are also dealt with, including waves guided by trenches and ridges. The emphasis is on surface acoustic wave devices and the treatment is written for electrical engineers. As such, there is almost no "mechanics style" presentation. Stress and strain are expressed as 6-element vectors and the elastic stiffness is a 6×6 matrix. Advanced chapters include Acoustic and Electromagnetic Analogies, Variational Methods, Perturbation Theory, and Composite Resonators. But there is also much good fundamental material here too.
 2. J. D. Achenbach, *Wave Propagation in Elastic Solids*, (North- Holland, Amsterdam, 1973) [library reserve]. *The standard in elastic waves in the past 25 years, this book has certainly sold more widely around the world than almost any other. It takes a conventional mechanics viewpoint and does not stray from this treatment. It offers a good introduction to elasticity and solves some simple harmonic problems as a prelude to 1-D waves on a string. Eventually, it develops 2 and 3-D waves, covering both plane and spherical waves and shows all basic wave phenomena. Reflection, transmission, and guided waves are dealt with. This treatment is close to what we will be doing in the first half of the semester.*
 3. L. M. Brekhovskikh, *Waves in Layered Media*, (Academic Press, New York, 1980) [not on reserve]. An advanced treatment with lots of diffraction integrals and a good discussion of the transfer matrix.
 4. I. A. Viktorov *Rayleigh and Lamb Waves*, (Plenum Press, New York, 1970) [**not** in our library]. Unfortunately, not available at ISU. It is a good book but out of print.
 5. H. Kolsky, *Stress Waves in Solids*, (Dover, New York, 1963) [library reserve]. Strong general treatment but heavy on waves in bars. Standard introduction for impact testing of metals. Brown Univ is famous for mechanics and materials.
 6. G. Kino, *Acoustic Waves : Devices, Imaging, and Analog Signal Processing*, (Prentice-Hall, New Jersey, 1987) [library reserve]. As the title indicates, it is intended for EEs who want to know ultrasound so they can build devices. Good basic stuff too, but again a strong EE flavor.
 7. K. Graff, *Elastic Waves in Solids*, (Dover, New York, 1992) [bookstore]. The course text. Excellently written, but dated, so there is no discussion of anisotropic media. The treatment of guided waves is about the most thorough and exhaustive I know of. All the details are included in the calculations; nothing is left out.
- ★ There are many other books, and you can find them by searching the catalog. But these are the major ones that have strong relevance to elastic waves as we will consider them.