

Bibliography: Physical Modeling of Musical Instruments

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Online Text for Music 420A

- J. O. Smith, **Physical Audio Signal Processing (PASP): for Virtual Musical Instruments and Digital Audio Effects**, <http://ccrma.stanford.edu/~jos/pasp/>, 2010. Text for Music 420A: “Signal Processing Models in Musical Acoustics”.

NOTE: The bibliography in PASP is far more up to date than that in this document. However, the older references are more usefully organized here by topic, and more information is given about them.

Most Recommended Musical Acoustics Books

- N. H. Fletcher and T. D. Rossing, **The Physics of Musical Instruments**, Springer-Verlag, 1998 (2nd ed.)— an excellent advanced musical acoustics text. Note that Prof. Rossing is at CCRMA this year teaching introductory musical acoustics (Music 150).
- P.M. Morse, **Vibration and Sound**, AIP for ASA, 1976 (1st ed. 1936, 2nd ed. 1948). An old classic. This inexpensive book can be ordered from The Acoustical Society of America. See <http://asa.aip.org/publications.html>.

Other Recommended Books

- **Applications of Digital Signal Processing to Audio and Acoustics**, edited by Mark Kahrs and Karlheinz Brandenburg, Kluwer Academic Publishers, 1998—the “Mohonk book,” an anthology of papers in signal processing applied to audio and music.
- I. G. Main, **Vibrations and Waves in Physics, Third Edition**, Cambridge University Press, 1993. (The best monograph I’ve seen on traveling wave mechanics)
- A. Hirschberg, J. Kergomard, and G. Weinreich, eds., **Mechanics of Musical Instruments**, Springer-Verlag, 1995. (More specialized, advanced musical acoustics text)

Other Related Books

- L. Cremer, **The Physics of the Violin**, MIT Press, 1984. (An intermediate to advanced musical acoustics book summarizing a lifetime of work in the field by a physicist and his students.)
- Allan D. Pierce, **Acoustics**, published by the American Institute of Physics, for the Acoustical Society of America, 1989. My favorite acoustics textbook. See <http://asa.aip.org/publications.html>.
- P. M. Morse and K. U. Ingard, **Theoretical Acoustics**, Princeton University Press, 1968. (Superb theory text)
- A. H. Benade, **Fundamentals of Musical Acoustics**, New York: Oxford University Press, 1976. Music ML3805.B456. (There is now a Dover version of this classic — very readable)
- J. D. Markel and A. H. Gray, **Linear Prediction of Speech**, New York: Springer-Verlag, 1976. (Excellent development of lattice and ladder digital filter forms. Advanced. Favorite reference on linear prediction)
- Curtis Roads, **The Computer Music Tutorial**, The MIT Press, Cambridge, MA, 1996. This 1234-page book contains extensive coverage of recent research and practice in computer music — it's the next best thing to a complete set of Computer Music Journals (CMJ) and International Computer Music Conference (ICMC) Proceedings.
- **The Music Machine**, edited by Curtis Roads, MIT Press, 1989. (Anthology of papers in computer music)
- Richard Boulanger, ed., **The Csound Book: Perspectives in Software Synthesis, Sound Design, Signal Processing, and Programming**, The MIT Press, March 2000. If you use CSound, this is a rich resource put together by a large number of experienced contributors.

Related CCRMA PhD Theses

- Julius Smith, **Techniques for Digital Filter Design & System Identification with Application to the Violin**, PhD/EE/CCRMA Dissertation, Stanford University, June 1983. Also available as a CCRMA publication, Dept. of Music, Stanford University, Stanford CA.
- Perry Cook, **Identification of Control Parameters in an Articulatory Vocal Tract Model, with Applications to the Synthesis of Singing**, PhD/EE/CCRMA Dissertation, Stanford University, Dec. 1990. Available as a CCRMA publication, Dept. of Music, Stanford University, Stanford CA.
- David Berners, **Acoustics and Signal Processing Techniques for Physical Modeling of Brass Instruments**, PhD/EE/CCRMA Dissertation, Stanford University, 1995. Available online at <http://ccrma.stanford.edu/~dpberner/>.

- Gary Scavone, **An Acoustic Analysis of Single-Reed Woodwind Instruments with an Emphasis on Design and Performance Issues and Digital Waveguide Modeling Techniques**, PhD/Music/CCRMA Dissertation, Stanford University, March 1997. Available as CCRMA Technical Report No. STAN-M-100 or from <ftp://ccrma-ftp.stanford.edu/pub/Publications/Theses/GaryScavoneThesis/>. (You purchase any CCRMA publication in the trailers from Tricia for the price of copying.)
- Stefan Bilbao, **Wave and Scattering Methods for the Numerical Integration of Partial Differential Equations**, PhD/EE/CCRMA Dissertation, Stanford University, June 2001. Also available as a CCRMA publication, Dept. of Music, Stanford University, Stanford CA. Also available online at <http://ccrma.stanford.edu/~bilbao/>.
- Hui-Ling (Vicky) Lu, **Toward a High-Quality Singing Synthesizer with Vocal Texture Control**, PhD/EE/CCRMA Dissertation, Stanford University, March 2002. <http://ccrma.stanford.edu/~vickylu/thesis/>
- Tim Stilson, **Efficiently Variable Algorithms in Virtual-Analog Music Synthesis—A Root-Locus Perspective**, PhD/EE/CCRMA Dissertation, Stanford University, March 2006. <http://ccrma.stanford.edu/~stilti/>
- Tamara Smyth, **Applications of Bioacoustics to the Development of Musical Instrument Technology**, PhD/Music/CCRMA Dissertation, Stanford University, March 2004.
- Stefania Serafin, **The sound of friction: real-time models, playability and musical applications**, PhD/Music/CCRMA Dissertation, Stanford University, March 2004.
- David Yeh, **Digital Implementation of Musical Distortion Circuits by Analysis and Simulation**, PhD/EE Dissertation, Stanford University, 2009. Available online at <http://ccrma.stanford.edu/~dtyeh/>.

See also the many related dissertations at the HUT Acoustics Lab: <http://www.acoustics.hut.fi/> such as

- Vesa Valimäki,
Discrete-Time Modeling of Acoustic Tubes Using Fractional Delay Filters, PhD/EE Thesis, Helsinki University of Technology, 1995. Available online at http://bekesy.hut.fi/~vpv/publications/vesa_phd.html This thesis contains a detailed exposition of fractional delay filtering with application to digital waveguides, and in-depth study of Lagrange interpolation and transient effects, etc.

References by Topic

This list of references can be used as a starting-point for further reading. The citations for each topic are generally listed in chronological order, except that the first reference cited may be my recommended best *single* reference (e.g., most recent and/or comprehensive).

Network Theory: [290, 175, 21]

Basic Circuit Theory: [61, 20]

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