

Department of Mechanical Engineering
University of California at Berkeley
ME 273 Oscillations in Linear Systems
Fall Semester 2018

Instructor: Fai Ma
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Consultation Hours: M 5.30-6.30 pm, WF 2.30-3.30 pm

Class Location and Website

MWF 4-5 pm, Etcheverry 1165; course website at <http://bcourses.berkeley.edu>

Course Prerequisite

ME 133 Mechanical Vibrations

Textbook

There is not a single book that covers the required material of this course. A good purchase is:
A. K. Chopra, *Dynamics of Structures: Theory and Applications to Earthquake Engineering*, 5th ed., Pearson, Hoboken, New Jersey, 2017.

Supplementary Reference

H. Benaroya, M. Nagurka and S. Han, *Mechanical Vibration: Analysis, Uncertainties, and Control*, 4th ed., CRC Press, Boca Raton, Florida, 2018.

Course Contents

Response of discrete and continuous dynamical systems, damped and undamped, to harmonic and general time-dependent loading. Convolution integrals and Fourier and Laplace transform methods. Lagrange's equations; eigensolutions; orthogonality; generalized coordinates; nonreciprocal and degenerate systems; Rayleigh's quotient.

Class Rules

Homework problems will be assigned from time to time. Two progress examinations are planned (the final examination will not be given on Thursday, 12/13/2018, 8-11 pm as originally scheduled). Examinations must be taken as scheduled. Approximate contributions to the final grade are as follows:

First Midterm on Friday, 10/5/2018, 4-5 pm	30%
Second Midterm on Friday, 11/2/2018, 4-5 pm	30%
Final Examination on Friday, 11/30/2018, 4-5 pm	40%

Course Objectives

To give a compact, consistent, and reasonably connected account of the theory of linear vibration at the advanced level. A secondary purpose is to survey some topics of contemporary research. Applications will be mentioned whenever feasible.

Additional References

G. Genta, *Vibration Dynamics and Control*, Springer, New York, 2009, available online at <http://www.springerlink.com/content/978-0-387-79579-9>

M. Geradin and D. J. Rixen, *Mechanical Vibrations: Theory and Application to Structural Dynamics*, 3rd ed., Wiley, West Sussex, United Kingdom, 2015.

D. T. Greenwood, *Principles of Dynamics*, 2nd ed., Prentice Hall, Englewood Cliffs, New Jersey, 1988.

P. Hagedorn and A. DasGupta, *Vibrations and Waves in Continuous Mechanical Systems*, Wiley, Hoboken, New Jersey, 2007.

R. A. Horn and C. R. Johnson, *Matrix Analysis*, Cambridge University Press, Cambridge, United Kingdom, 1985.

J. L. Humar, *Dynamics of Structures*, 3rd ed., CRC Press, Boca Raton, Florida, 2012.

D. J. Inman, *Engineering Vibration*, 4th ed., Pearson, Upper Saddle River, New Jersey, 2014.

P. Lancaster, *Lambda-Matrices and Vibrating Systems*, Pergamon Press, Oxford, United Kingdom, 1966.

L. Meirovitch, *Principles and Techniques of Vibrations*, Prentice Hall, Upper Saddle River, New Jersey, 1997.

D. E. Newland, *Mechanical Vibration Analysis and Computation*, Longman, Essex, United Kingdom, 1989 (republished by Dover, New York, 2006).

S. S. Rao, *Mechanical Vibrations*, 6th ed., Pearson, Hoboken, New Jersey, 2017.

T. D. Rossing and N. H. Fletcher, *Principles of Vibration and Sound*, 2nd ed., Springer, New York, 2004.

J. W. Strutt (Lord Rayleigh), *The Theory of Sound*, Vol. I, Dover, New York, 1945 (reprint of the 1894 edition).

W. Weaver, Jr., S. P. Timoshenko and D. H. Young, *Vibration Problems in Engineering*, 5th ed., Wiley-Interscience, New York, 1990.