

MECH 364
MECHANICAL VIBRATIONS
4 Credits, 2nd Semester 2009/10
(Tuesdays and Thursdays, 8:00-9:30 a.m.)
Room: DMP 301

Course Web Site: www.mech.ubc.ca/~ial

Instructor

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Course Objectives

This course deals with observation, analysis, and modification of vibration in mechanical systems. In addition to analysis and experimentation, practical applications and design considerations related to modifying the vibrational behavior of mechanical devices and structures will also be studied. This understanding is important for humans, particularly engineers, as there are desirable types of vibration such as those generated by musical instruments and by vibrators used in physiotherapy, industrial part feeders and sorters; and undesirable and harmful types of vibration such as those generated by construction equipment, road irregularities, and due to earthquakes.

Natural or free mechanical vibration is a manifestation of the oscillatory behavior in a mechanical system, as a result of repetitive interchange of kinetic and potential energies among components in the system. Such oscillatory response is not limited to purely mechanical systems, and is found in electrical and fluid systems as well, again due to a repetitive exchange of two types of energy among system components. Forced vibration is resulted due to oscillatory forces that excite a system. In this course we will limit our attention to vibration in mechanical systems. Both translatory and rotatory mechanical systems will be considered. Linear, multi-degree-of-freedom (lumped-parameter) systems will be studied, and some attention will be given to distributed-parameter (continuous) systems. Topics covered in the course will include response analysis, both in the time domain and the frequency domain, vibration monitoring and instrumentation, modal analysis including experimental techniques, mechanical damping (energy dissipation), computational techniques, and design and control of mechanical systems for modifying their vibration characteristics. The course will include mandatory laboratory exercises.

Textbook:

De Silva, C.W., *VIBRATION—Fundamentals and Practice*, 2nd Edition, Taylor&Francis/CRC Press, Boca Raton, FL, 2007.

MECH 364 -- COURSE LAYOUT

Week	Starts	Topic	Read
1	Jan 05	Introduction	Chapter 1
2	Jan 12	Vibration in Practice	Chapter 1
3	Jan 19	Vibration Instrumentation	Chapters 8 & 9
4	Jan 26	Time Response, Free	Chapter 2
5	Feb 02	Time Response, Forced	Chapter 2
6	Feb 09	Frequency Response	Chapter 3
7	Mar 02	Frequency Response, Impedance Approach	Chapter 3
8	Mar 09	Multi D.O.F. Systems	Chapter 5
9	Mar 16	Modal Analysis	Chapter 5
10	Mar 23 Thursday, Mar 25:	Vibration Design and Control: Vibration Isolation Intermediate Exam (In Class)	Chapter 12 Sections 12.1-12.3
11	Mar 30	Distributed-Parameter Systems	Chapter 6
12	Apr 06	Distributed-Parameter Systems	Chapter 6
13	Apr 13	Energy Dissipation and Damping	Chapter 7

Grade Composition

Laboratory Exercises	15%
Mid-Term Examination	35%
Final Examination	<u>50%</u>
Total	<u>100%</u>