

Mechanical Vibrations III (2002)

20-263-663/664

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Lecture Room: 616B Rieveschl Hall

Laboratory Room: 584C & 584A Rhodes Hall

Reference Texts: Only the first text is required.

UC-SDRL-CN-20-263-663/664

Vibrations: Experimental Modal Analysis

Allemang, et al

1999, 250 pp. (approx.)

Theory of Vibrations with Applications

Fourth Edition (1993)

William T. Thomson

Prentice Hall

Mechanical Vibrations, Second Edition (1978)

Tse, Morse, Hinkle

Marcel Dekker, Inc.

Engineering Vibration, First Edition (1994)

Inman, D.J.

Prentice-Hall, Inc.

UC-SDRL-CN-20-263-662

Vibrations: Analytical and Experimental Modal Analysis

Allemang, et al

1999, 160 pp. (approx.)

Grading:

Grading will be based upon the following weighting of the Mid-Term Test and laboratory exercises.

<i>Mid-Term Test</i>	<i>30% (Individual)</i>
<i>FRF Data Analysis Test Report</i>	<i>20% (Individual)</i>
<i>Circular Plate Test Report</i>	<i>15% (Group)</i>
<i>Oral Presentation</i>	<i>15% (Group)</i>
<i>Written Report</i>	<i>20% (Group)</i>

Homework:

Homework is assigned for the benefit of the student to emphasize areas of importance in the material. Some questions on the tests will be similar to assigned homework. Homework assignments are generally minimal in this class.

Tests:

The Mid-Term Test is currently scheduled for the Thursday class period of the sixth week of classes (May 2). This is subject to change. Test questions of a numerical nature will be similar to classroom discussions or material presented in the text. Questions about what is demonstrated in the laboratory exercises will be included. Other test questions will be conceptual in nature requiring short written or numerical work. These questions will utilize the reading assignments but will primarily be taken from material presented or discussed in the class lectures.

Course Goals:

The text and material to be covered have been selected to give the student a experimental background in mechanical vibrations of real structures. Specific goals of this course are:

- *Develop theoretical and practical understanding of pertinent digital signal processing details utilized by modern data acquisition systems.*
- *Develop theoretical and practical understanding of the approaches used to develop frequency response function estimates from experimentally measured data.*
- *Understand the major categories of experimental modal analysis methods.*
- *Understand the concepts involved in modern modal parameter estimation algorithms.*
- *Utilize modern modal parameter estimation algorithms to determine modal parameters (frequencies, damping, modal shapes, modal scaling).*
- *Develop intuition with respect to experimental techniques, particularly as applied to mechanical vibrations.*
- *Understand the relationships between degrees of freedom and measurement degrees of freedom.*
- *Prepare the student for experimental and theoretical work required in later courses (System Dynamic Analysis I, II, III).*

Pertinent Course Dates:

Week 1	March 25 - March 29
Week 2	April 1 - April 5
Week 3	April 8 - April 12
Week 4	April 15 - April 19 (RJA Out of Town 15-16)
Week 5	April 22 - April 26
Week 6	April 29 - May 3 (Mid-Term Test)
Week 7	May 6 - May 10
Week 8	May 13 - May 17 (RJA Out of Town 15-19)
Week 9	May 20 - May 24
Week 10	May 27 - May 31
Week 11	June 3 - June 6 (Exam Week)

Reminders:

- *All oral presentations will take place during the regularly scheduled class and laboratory times during the TENTH week of the quarter. Check my door or with Rhonda Christman in Room 584D, Rhodes Hall to confirm the location.*
- *The cost of the notes for the class is 0.05 per page payable to Rhonda Christman in Room 584D, Rhodes Hall. Wait until all notes have been passed out and then pay. Checks should be made out to the University of Cincinnati. If notes are not paid for, grades will not be submitted.*
- *Be sure to meet with me to get review your test objectives and plan before your test date. I will assign a research assistant to advise you on your test at that time. Do not delay or we will run out of time. Try to schedule all testing before May 15 or 16 to allow time for analysis of the data prior to the oral presentation.*
- *Remember.... The laboratory experience is a learning experience. There is no "correct" answer. We expect you to make mistakes.*

<i>Vibrations III Course Outline:</i>			
<i>Date</i>	<i>Topic</i>	<i>Reading Reference</i>	
<i>Week 1</i>	<i>Review Vibrations II Modal Analysis History Review Math</i>	<i>UC-SDRL-CN-20-263-663/664 UC-SDRL-CN-20-263-663/664</i>	<i>Chapters 1-2 Chapter 3 Appendix A</i>
<i>Week 2</i>	<i>Modal Parameter Estimation Appendix B</i>	<i>UC-SDRL-CN-20-263-663/664</i>	<i>Chapter 6</i>
<i>Week 3</i>	<i>Modal Parameter Estimation</i>	<i>UC-SDRL-CN-20-263-663/664</i>	<i>Chapter 6</i>
<i>Week 4</i>	<i>Modal Parameter Estimation</i>	<i>UC-SDRL-CN-20-263-663/664</i>	<i>Chapter 6</i>
<i>Week 5</i>	<i>Digital Signal Processing</i>	<i>UC-SDRL-CN-20-263-663/664</i>	<i>Chapter 4</i>
<i>Week 6</i>	<i>FRF Measurements Mid-Term Test</i>	<i>UC-SDRL-CN-20-263-663/664</i>	<i>Chapter 5</i>
<i>Week 7</i>	<i>Group Project</i>		
<i>Week 8</i>	<i>Group Project</i>		
<i>Week 9</i>	<i>Group Project Oral Presentations</i>		
<i>Week 10</i>	<i>Group Project</i>		
<i>Week 11</i>	<i>Exam Week - No Final Exam</i>		

<i>Vibrations III Course Schedule</i>	
<i>Date</i>	<i>Assignment Schedule</i>
<i>Week 1</i>	<i>MATLAB Assignment</i>
<i>Week 2</i>	<i>MATLAB Assignment</i>
<i>Week 3</i>	<i>Group Member Organization / Project Choice MATLAB Assignment</i>
<i>Week 4</i>	<i>FRF Data Analysis Report Due (Thursday Class) MATLAB Assignment</i>
<i>Week 5</i>	<i>MATLAB Assignment</i>
<i>Week 6</i>	<i>Mid-Term Exam Group Circular Plate Project Report Due (Thursday Class)</i>
<i>Week 7</i>	
<i>Week 8</i>	
<i>Week 9</i>	
<i>Week 10</i>	<i>Group Project Oral Report Due (Tuesday Class) Group Project Written Report Due (Friday Noon)</i>

<i>Vibrations III - Oral Report Evaluation</i>							
<i>Project Title:</i>							
<i>Project Team:</i>							
<i>Grade:</i>	<i>70</i>	<i>75</i>	<i>80</i>	<i>85</i>	<i>90</i>	<i>95</i>	<i>100</i>
<i>Presentation of Project:</i>							
<i>Introduction</i> <i>Discussion of Test</i> <i>Discussion of Results</i> <i>Discussion of Errors</i> <i>Summary/Conclusions</i>							
<i>Educational Content:</i>							
<i>Use of Presentation Materials:</i>							
<i>Bullet Slides</i> <i>Viewgraphs</i> <i>Video/Film, 35 mm Slides</i>							
<i>Participation of Team Members:</i>							
<i>Use of Allowable Time:</i>							
<i>General Comments:</i>							
<i>Overall Grade:</i>							

<i>Vibrations III - Written Report Evaluation</i>							
<i>Project Title:</i>							
<i>Project Team:</i>							
<i>Grade:</i>	<i>70</i>	<i>75</i>	<i>80</i>	<i>85</i>	<i>90</i>	<i>95</i>	<i>100</i>
<i>Report Format:</i>							
<i>Abstract</i> <i>Table of Contents</i> <i>Introduction - Overview</i> <i>Experimental Procedure</i> <i>Discussion of Results</i> <i>Discussion of Errors</i> <i>Summary/Conclusions</i> <i>Acknowledgements</i> <i>Appendix: Pertinent Theory</i> <i>Appendix: References</i> <i>Appendix: Figures, Plots, Graphs, Tables, Programs</i>							
<i>Ability to Reconstruct Test:</i> <i>(Based upon written report)</i>							
<i>Written Report Characteristics:</i>							
<i>English Grammar</i> <i>Spelling</i> <i>Concise</i> <i>Format, Appearance</i>							
<i>General Comments:</i>							
<i>Overall Grade:</i>							

<i>Vibrations III - Project Team Assignment</i>
<i>Name:</i>
<i>Phone:</i>
<i>Project Interest</i> <ul style="list-style-type: none"><input type="checkbox"/> <i>General Modal Test (Vehicle, Frame, ??)</i><input type="checkbox"/> <i>Automotive Test (Body In White)</i><input type="checkbox"/> <i>Modal Test of _____</i><input type="checkbox"/> <i>Modal Test - Coordinate with Finite Element Class</i><input type="checkbox"/> <i>Modal Test - Coordinate with Acoustics Class</i><input type="checkbox"/> <i>Other</i>
<i>Possible Team Members</i>
<i>Relevant Experience</i> <ul style="list-style-type: none"><input type="checkbox"/> <i>SDRC/MTS Ideas Test Software</i><input type="checkbox"/> <i>LMS CADA-X Software</i><input type="checkbox"/> <i>Zonic Software</i><input type="checkbox"/> <i>Data Physics Software</i><input type="checkbox"/> <i>Entek Software</i><input type="checkbox"/> <i>SmartOffice Software</i><input type="checkbox"/> <i>Vibration Testing Experience</i> <input type="checkbox"/> <i>Transform Techniques Course</i><input type="checkbox"/> <i>Finite Element Course</i><input type="checkbox"/> <i>Boundary Element Course</i><input type="checkbox"/> <i>Acoustics Course</i> <input type="checkbox"/> <i>Other Experience</i>