Analytical Mechanics & Vibrations
EGR 463
Spring 2023

Instructor: Kurt DeGoede (Professor of Engineering and Physics)
160-E Esbenshade Hall
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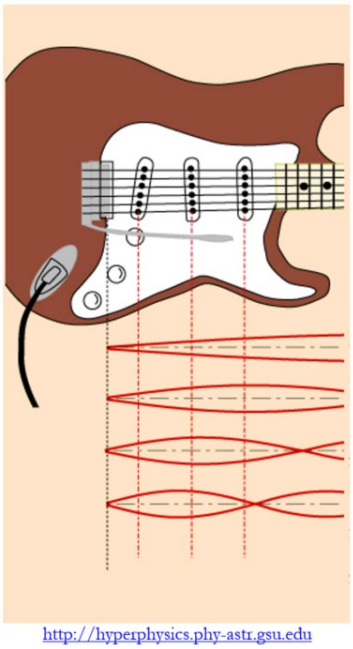
Help Sessions (Office Hours): M 11:00 -12:20; Th 12:30 – 3:20; F 12:20 – 1:50
Or by appointment. Please feel free to stop by my office anytime, if my door is closed please leave a note.

Class Meetings: Tu & Th 11:00 – 12:20 E184.


http://hyperphysics.phy-astr.gsu.edu

Text Available on Knovel (link):

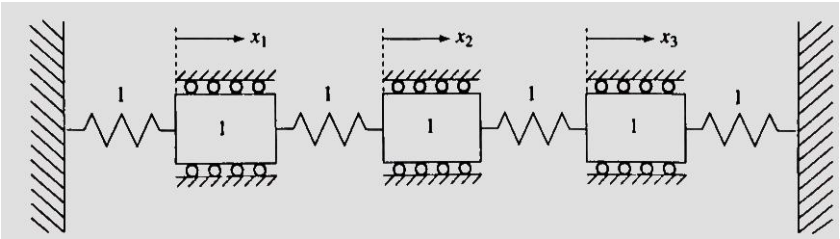
ISBN Number:	978-0-19-514246-4
Author:	Tongue
Title:	Principles of Vibration
Edition and Copyright:	2nd , 2002
Publisher:	Oxford

Course Description: Lagrangian formulations for three-dimensional motion of particles and rigid bodies. Linear free and forced responses of one and multi degree of freedom systems and simple continuous systems. Introduction to vibration control/absorption.

Course Objectives: The students will learn to use Lagrangian mechanics to solve advanced problems in dynamics and vibrations (ABET outcome 1). Students will develop an analytical understanding of single- and Multi-degree-of-freedom free and forced responses (ABET 1).

They will use Simscape Multibody (MATLAB Simulink) and other computational tools to model complex dynamic systems (ABET 1), including appropriate approximation methods (ABET 1). Students will design vibration isolators (ABET 2) and conduct engineering analysis of design alternatives for dynamic systems (ABET 6). Students will document simulation results in clear, concise, professionally formatted technical reports (ABET 3).

Prerequisites: EGR360, MA321



Course Topics and Work (Tentative):

1. **Intro and Review (1 session)**
2. **Lagrangian Mechanics (5 sessions)**
   HW1 and 2
   Proficiency Quiz 1-Mastery Exam 1
3. **Dynamic System Modeling (4 sessions)**
   Modeling Assignments 1 and 2
4. **1 DOF Systems (7 sessions)**
   HW3 and 4
   1-DOF Modeling 1, 2, and 3
   Proficiency Quiz 2-Mastery Exam 2 (covers 1 DOF and n-DOF)
5. **Multi-DOF Systems (6 sessions)**
   HW5
   n-DOF Modeling 1, 2, and 3
   Proficiency Quiz 2-Mastery Exam 2 (covers 1 DOF and n-DOF)
6. **Advanced Modeling (5 sessions)**
   Capstone Modeling 1 and 2

Grading: 15 Grades (5 points each)

Universal Rubric

5 pts Outstanding (A)
4 pts Good (B)
3 pts Adequate (C)
2 pts Week (D)
1 pts Meets Minimum Expectations (F)
0 pts Missing or Below Minimum Expectations (0)

Final Grades. With your new dynamic modeling skills, you will clearly be a ME Wizard – levels of Wizardry:

71-75	Gandalf		A
66-70	Harry Potter		A–
61-65	Merlin		B+
56-60	The White Witch		B
51-55	Dr. Strange		B–
46-50	Willow Rosenberg		C+
41-45	Dumbledore		C
36-40	Sauron		C–
31-35	Rasputin		D+
26-30	David Copperfield		D
21-25	John Constantine		D–

Tentative Schedule:

Tue	Thu
Jan 17 Course Introduction and Intro to Lagrange/Review of Energy Analysis	Lagrange – Conservative Systems
24 Lagrange – Non-conservative Sys.	Lagrange - Multipliers
31 Simscape Multibody Tutorial 1	Simscape Multibody Tutorial 2
Feb 7 Lagrange – Coaching	Quiz1-Exam1
14 Simscape – Belts and Rolling	Simscape Coaching
21 Applied Modeling – Phase 1	Applied Modeling – Phase 1
28 Applied Modeling – Phase 1	1-DOF Vibration – Free Response
Mar 7 S P R I N G	B R E A K
14 1-DOF Vibration – Forced-Undamped	1-DOF Vibration – Forced-Damped
21 1-DOF Modeling – Part 1	1-DOF Modeling – Part 2
28 Isolator Design (2-DOF preview)	1-DOF Modeling – Part 3
Apr 4 n-DOF Theory – Part 1	n-DOF Theory – Part 2
11 Applied Modeling Phase 2	Applied Modeling Phase 2
18 n-DOF Modeling – Part 1	n-DOF Modeling – Part 2
25 **SCAD – No Classes**	n-DOF Modeling – Part 3
May 2 Quiz2-Exam2	**Reading Day (Final Exams)**

Final Exam: Capstone Modeling Presentations

Ethics: It is very important to me that our classroom, and the larger Etown College community, be a place of mutual respect, belonging, and affirmation. I consider this classroom to be a place where you will be treated with respect, and I welcome individuals of all ages, backgrounds, beliefs, ethnicities, genders, gender identities, gender expressions, national origins, religious affiliations, sexual orientations, ability - and other visible and non-visible differences. If I do something to inadvertently cause hurt or offense, please let me know.

All members of this class are expected to create and uphold a respectful, welcoming, and inclusive learning environment towards the instructor and one another, at all times. Failure to adhere to these expectations will result in being asked to leave and application of the student conduct process for disruptive and disorderly conduct, harassment, or other violations as applicable. The student code of conduct and the NSPE code of ethics (Cannons attached, with Etown Engineering Professional Obligations) applies in the classroom, other learning spaces, and to participation in all virtual activities, including, for example, Zoom sessions and Canvas.

All work should represent each student's individual efforts. **Students are encouraged to discuss assignments with other students and/or the instructor, however submitted assignments should reflect the student's own work and understanding.** Any solution obtained from any source should be properly referenced.

All **quizzes and exams** will be taken using only the "Just the Facts+" packet and a calculator approved for use on the FE/PE exams (http://ncees.org/exams/calculator/). The use of any other electronic device (graphing calculators, cell phones, smartwatches, headphones, etc.) is strictly prohibited. Assessments are to be taken without communication, except for problem clarification from the instructor. Students will not be permitted to leave the classroom during assessments. Exceptions will be granted at the professor's discretion.

Dishonest practice will result in a minimum of a one full letter grade reduction in the final course grade; repeated violations can result in failure of the course and possibly expulsion from the college.

Re-Grading: Written requests, with full rationale, for re-grading of all course-work will be accepted the next class period after original materials are returned to the students.

Disabilities Statement

Religious Observance

Support Services:

- **Learning Zone** (Tutoring Services): Baugher Student Center 226-239, learningZone@etown.edu, 717-361-1185 and 717-361-1549
- **Technology Help**: Nicarry 108, helpdesk@etown.edu, 717-361-3333
- **Student Health and Wellness**: Katy Frey, RN, at LGH Sycamore Square, 717-588-1059
- **Counseling Center**: BSC 216, Bruce Lynch, lynchbg@etown.edu, 717-361-1300
- **Disability Services:** BSC 228, Lynne Davies, daviesl@etown.edu, 717-361-1227
- **International Students Office**: Nicarry 119, Maria Petty, pettym@etown.edu, 717-361-1594
- **Office of Diversity, Equity, and Belonging:** BSC 210, Nichole Gonzales, gonzaleznichole@etown.edu, 717.361.1179
- **Chaplain and Religious Life:** BSC 253, Rev. Amy Shorner-Johnson, shornera@etown.edu, 717-361-1260
- **Engineering and Physics Department:** Esbenshade 160F, Jennifer McFadden, mcfaddenj@etown.edu, 717-361-1392

Fine Print: The preceding information represents the *intent* of the course and is subject to change at the discretion of the instructor.

Elizabethtown Engineering Program Code of Ethics

I. Hold paramount the safety, health, and welfare of fellow students.
II. Perform project tasks and assignments only in the areas of their competence.
III. Submit assignments only in an objective and truthful manner.
IV. Act for team members, instructors, or employers as faithful agents or trustees.
V. Avoid deceptive acts.
VI. Conduct themselves responsibly, ethically, lawfully, and in line with the integrity policy so as to enhance the honor, reputation, and usefulness of the profession and college's engineering department.

Professional Obligations (Etown Engineering Students)

1. **Engineering students shall be guided in all their relations by the highest standards of honesty and integrity.**
   A. Be honest about your mistakes.
   B. Do not cheat on exams or assignments.
   C. Do not plagiarize or falsify data.
   D. Do not aid or abet another student in unethical behavior.
2. **Engineers shall at all times strive to gain the knowledge to serve the public's interest.**
   A. Your goal in class should be to gain knowledge to justify your intended degree, not just to obtain a high grade.
   B. Work for the advancement of society and the profession by engaging in the community, and recruiting youth to the engineering profession.
   C. Inform professors of unethical requests from other students.
3. **Engineers shall avoid all conduct or practice that deceives other students, instructors, or the public.**
   A. In lab work, be truthful with ALL data, even if it is not favorable.
   B. All assignments should be your own original work unless otherwise noted.
   C. Do not finish and submit team projects without the approval of ALL your other team members.
4. **Engineers shall not disclose confidential information concerning their own group work to any person outside of their group except for the professor.**
   A. Do not put individual assignments in your public folder.
   B. Do not spread the word of quiz questions or unannounced assignments to later sections of a course.
   C. Engineering students who are or have been a TA shall not disclose information about tests and grades of other students.
   D. Do not disclose or use information learned from the internships that have to do with processes, or techniques of production.
5. **Engineering students shall not be influenced in their scholastic duties by conflicting interests.**
   A. Do not attempt to receive a favorable grade or recommendation by establishing an unprofessional relationship with a professor.
   B. In peer assessments or as a TA, do not allow friendships or grades to sway judgment
   C. Do not attempt to gain favor in class or for assignments through flattery of professors.

6. **Students should not attempt to gain advancement by downgrading other students' work or by other questionable methods.**
   A. Credit should be awarded where it is deserved when submitting group work.
   B. If another student does exceptional work, do not take credit for it if it is not your work.
   C. If another student is performing inadequate work, calmly confront them about it before addressing it to the professor.
   D. Students shall not sabotage the projects or advancements done by other students.
   E. Do not blame group members for their own behavior.
   F. Do not blame professors or staff for their grades.
7. **Engineering students should not attempt to injure the reputation of the engineering department or the reputation of professors and engineers in the department.**
   A. If other engineering students are injuring the reputation of the department, you should inform the head of the department or the professor of their actions.
   B. Every student in the department's actions should coincide with the integrity policy of the college to avoid degrading the department.
   C. Students shall report malicious activities to the Head of the Engineering Department, or appropriate instructor. Yet, the student shall not tell others of the issue.
8. **Engineering students should accept personal responsibility for all of the work they do for the department and for their group.**
   A. Students shall act truthfully when accused of misconduct.
   B. Blame for violations of the integrity policy should not be placed on the department or professors, but rather on the individual who committed them.
   C. Students should also accept the blame if their group submits unethical work because it is their responsibility to ensure any submission with their name on it is held to high ethical standards.
9. **Engineering students shall give credit for engineering work to those to whom credit is due, and will recognize the proprietary interests of others.**
   A. Students shall not steal programs or work from other engineers or students from the internet through illegal networks.
   B. Students shall properly cite information in all manners of presentation such as research papers, essays, PowerPoints, etc.

Obligations written by Etown Engineering students Class of 2021
Cannons adapted from: https://www.nspe.org/resources/ethics/code-ethics