Version 2 (Aug 26, 2024)

ME 308 Mechanical Vibrations

[ON CAMPUS]

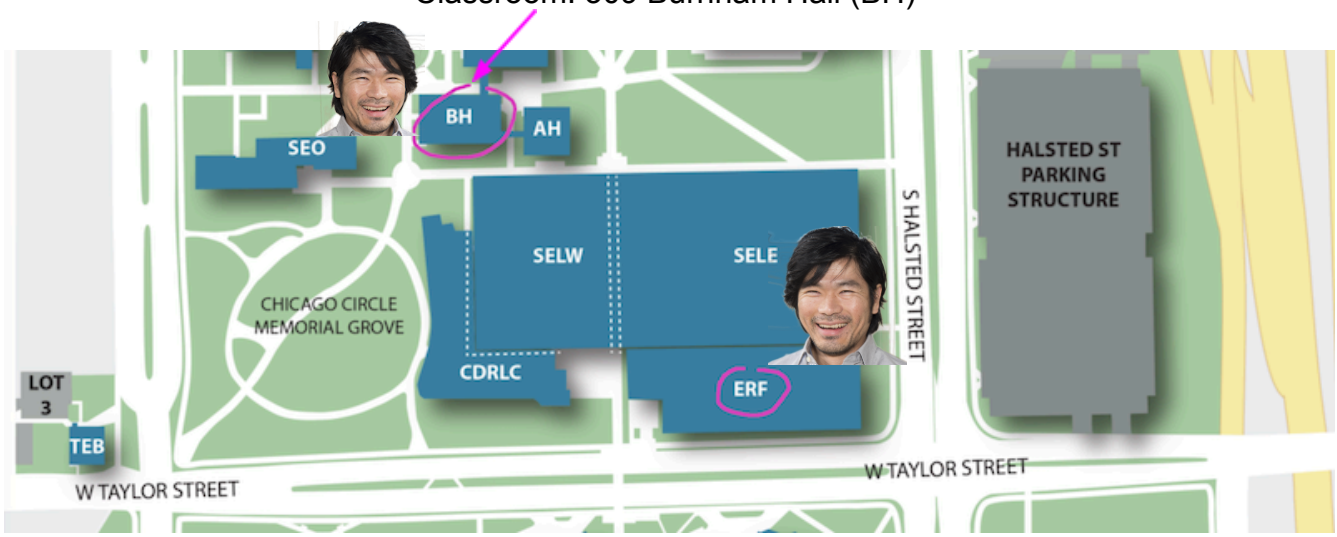
CRN: 29574

Fall 2024

Prof. Yeow Siow, Office: 3033 ERF, yeowsiow@uic.edu

Class Meetings: MWF 12 pm – 12:50 pm CST

Classroom: 309 Burnham Hall (BH)



Essential Learning Resources You Will Need:

1. Class homepage, detailed schedule: https://me308-siow.class.uic.edu
2. Gradescope
3. Discord
4. Piazza
5. Tracker (https://physlets.org/tracker/)
6. Octave (https://octave.org/download) or Matlab or other similar languages)
7. Google Docs/Sheets/Slides
8. Phone/laptop/tablet/pen/paper to bring to classroom
9. Reference book: Shabana, "Theory of Vibration" 2nd ed., Springer-Verlag. ISBN-13: 978-1-4612-3976-5

Vibrations

Prerequisites: CS 109 (or equivalent), ME 210, MATH 220

Course Catalog Description: Free and forced vibrations of damped linear single and multiple degree of freedom systems. Approximate methods, instrumentation, and applications (Translation: Learn how to reasonably analyze anything that vibrates!)

Course Goals: This course introduces students to basic concepts in mechanical vibrations and associated mathematics, and theoretical and computational analysis tools. The following fundamental concepts and techniques are also a part of this course: Linear algebra, matrix algebra, numerical and analytical calculations for the equation of motion, solutions to ordinary differential equations

ABET Outcomes: 1. Ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science and mathematics, 2. Ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors

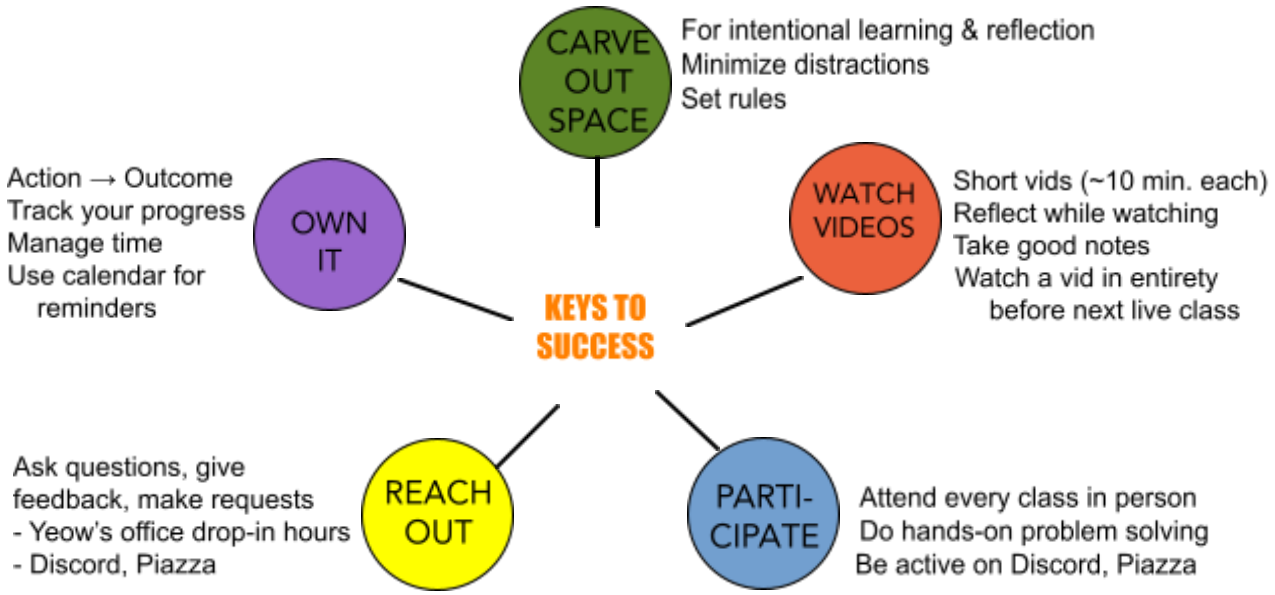
Learning Objectives: 1. Approach and solve problems with **technical rigor** (i.e., compliance with physics, mathematically sound)
2. Communicate your work effectively and **professionally** to the outside world
3. Provide **rationale** behind, **justification** for, and **reflection** of, your work

I will do my best to impart knowledge and provide guidance along the way, and ultimately it is up to you how much you want to accomplish!

I firmly believe in a *growth mindset*, that *each and every one of you* – the learner – can succeed in my class, regardless of your identity or life experiences.

Course materials and assignments can be complex and challenging, but they are crucial to your intellectual and personal growth and development. There are times you may need extra help. Students who attend class consistently, complete all assignments, thoughtfully engage with feedback on work, develop good study strategies, visit the tutoring center, and contact faculty when they are struggling can develop a thorough understanding of the course material and ultimately succeed in the course!

I have devised the following "5 Keys to Success" in this class for you.



Own your learning. Be accountable to yourself. Be an active participant of this learning community that's this class, and let's make this class a safe space to freely share ideas and be constructive.

Beyond your learning, on a system level your feedback will help improve this course, the ME undergraduate curriculum, and my teaching. I therefore ask that you complete the UIC course evaluation at the end of this semester.

Grading...and the meaning of letter grades

I've replaced the conventional 100-point percentage scale with a "fluency" system:

Total Fluency Points Earned	UIC Grade	Meaning
≥ 87	A	**Celebrated**: Passing + successful demonstration of three projects; you've shown grit, consistency, and a deep understanding of the subject; you're a lifelong learner
80	B	**Strengthened**: Passing + successful demonstration of two projects; you've become a well-rounded problem solver
73	C	**Elevated**: Passing + successful demonstration of one project; you've achieved a higher level understanding of the subject
66	D	**Passing**: Successful completion of all VLRs and ICPs; you're engaged throughout semester

Each fluency point, FP, means something: Acquiring an FP means that you've put in authentic effort and successfully demonstrated fluency in the subject matter through completion of various tasks.

It's up to you to pick and choose, mix and match, and take on any number of tasks as you wish! The fluency system is designed to give you flexibility, and an opportunity to customize your learning according to how much you want to achieve – or what final grade you aim for.

Then simply add all the FPs you've acquired (after any late adjustments) – no percentages, no weighting scale. It's all transparent.

Here are the task categories:

- Video Lecture Reflection (**VLR**) = 1 FP each (33 max)
- In-Class Practice (**ICP**) = 1 FP each (33 max)
- Project Pre-Planning (**PPP**) = 1 FP each (4 projects planned, so 4 max)
- **Projects** = 6 FPs each (4 projects planned, so 24 max)
- Random bonus tasks

All tasks except bonuses will be released, submitted (uploaded by you), and graded on Gradescope using an expectation rubric I'll share with you along with the task description. The grading rubric is based on the three learning objectives stated above: **Technical rigor**, **professionalism**, and **rationale/justification/reflection**.

"Half-Life" Late Submissions

To help motivate you to keep up with the pace, but also recognizing that life sometimes just doesn't go the way you've intended, all tasks have two due dates: *On-time* and *late*.

An on-time submission will be fully rewarded according to how much it satisfies the rubric expectation. And if you miss a due date, you can submit it late – no questions asked! – and still be able to earn partial FP.

Unless accommodated, all work submitted past the on-time due date will be subject to a reduction in FP based on the half-life formula: $FP_A = FP_0 \cdot \left(\frac{1}{2}\right)^t$, where FP_A is the actual FP awarded, FP_O the original FP, and t the elapsed time past the due date cutoff, measured in days. Any lateness, down to the seconds, will be rounded *up* to the next number of days (e.g., 3 hours late = 1 day; 29 hours late = 2 days; etc.).

Vibrations

Due Date Accommodation

I welcome requests for accommodation! The “half-life” principle above does not apply if you have an official accommodation. An accommodation can be given if ***prior*** notifications are approved (e.g., DRC accommodation, UIC religious observation, student org competition travel, student athlete away game, etc.), or if it's due to an emergency – simply provide me with relevant documentation afterwards.

Important Dates

Last day to drop a class without “W”: Sep 6, 2024 (Fri)
Last day to drop a class with “W”: Nov 1, 2024 (Fri)

Integrity Policy

I highly value originality and authenticity, which serve as the basis for the fluency system introduced above. To ensure fairness and, ultimately, achieve equity among all students, a good starting point is for everyone to comply with UIC academic integrity policy. Did you know that forgetting to cite other people’s work in your writing could be viewed as plagiarism? Or, worse yet, copy-paste from Wikipedia verbatim?

Use of generative AI is encouraged, to make your workflow more efficient and to help you learn (see UIC statement). AI tools, however, are not permitted as co-author for any written deliverable in this course.

Emergency Preparedness

Download UIC SAFE app. And memorize this number: UIC Police 312-355-5555 (or 5-5555 on any campus phone).

Schedule and Content

Week	Day	Date	Topic
1	1	8/26	Welcome!
	2	8/28	FBD review
	3	8/30	More FBD
2	1	9/2	LABOR DAY RECESS
	2	9/4	ID, EOM
	3	9/6	Triangles
3	1	9/9	Linearization
	2	9/11	4 ingredients of response
	3	9/13	*** PROJECT DEMO ***
4	1	9/16	Equivalent springs
	2	9/18	Continuous systems
	3	9/20	Modeling of structures
5	1	9/23	Solving ODEs: Hand vs machine
	2	9/25	Math: Homogeneous, cases A-C
	3	9/27	Math: Nonhomogeneous
6	1	9/30	1-DOF: Free undamped
	2	10/2	Free damped
	3	10/4	Log decrement

7	1	10/7	*** PROJECT DEMO ***
	2	10/9	*** PROJECT WORK DAY ***
	3	10/11	*** PROJECT WORK DAY ***
8	1	10/14	Coulomb damping
	2	10/16	Harmonic: Forced undamped
	3	10/18	Beats & Resonance
9	1	10/21	Forced damped
	2	10/23	Force transmissibility
	3	10/25	Motion Transmissibility
10	1	10/28	*** PROJECT DEMO ***
	2	10/30	Nonharmonic: Periodic, Fourier
	3	11/1	Fourier: Example
11	1	11/4	Fourier: Odd, even
	2	11/6	Fourier: Solve for xp
	3	11/8	*** PROJECT Q&A ***
12	1	11/11	Impulsive
	2	11/13	Arbitrary
	3	11/15	*** PROJECT DEMO ***
13	1	11/18	Recap: Forced
	2	11/20	Energy dissipation, structural damping
	3	11/22	*** PROJECT Q&A ***
14	1	11/25	MDOF: Why, matrix
	2	11/27	THANKSGIVING RECESS
	3	11/29	THANKSGIVING RECESS
15	1	12/2	2-DOF: Free undamped, mode shapes
	2	12/4	2-DOF: Free damped forced undamped
	3	12/6	2-DOF: Forced, damped

See class website for assignments and due dates.