AE 370

AKA how math is fun and powerful

Numerical methods:

Drive understanding of the natural world

Inform new landscapes for the engineered world







Goals for this class

Understand the mathematical fundamentals of prominent aerospace numerical methods

Be able to implement and apply these methods using <u>code</u>

Clearly <u>communicate</u> the application of these methods to challenging, open-ended problems through technical writing

Grow your <u>comfort and appreciation</u> for the beauty and power of mathematics and code

(have the ability to build off of 370 to develop methods for harder problems)

Weekly structure

Mondays: labs

- Concept review + coding (topics from previous week)
- We will work on a portion of that week's HW (yay for head starts!)

Goal: hands-on practice on understanding and implementing the material for homework-level problems

Wednesdays and Fridays: lectures

New concepts (theory)

	Μ	Tu	W	Th	F	Sa	Su
Lecture							
Take quiz							
Lab							
Do HW							

Imperatives

Embrace math and coding

Embrace failure

Engage with the course material and your peers!

Time management

Check the website!



IT'S IN THE SYLLABUS

This message brought to you by every instructor that ever lived.

https://uiuc-ae370.github.io/

WEBSITE

What are numerical methods?

We want to robustly & efficiently predict complex engineering phenomena

— How do we turn that into a mathematical question?

To motivate this aim, remember the butterfly flapping video from lecture 1.

The flow dynamics are governed by Naiver-Stokes

$$\frac{\partial \mathbf{u}}{\partial t} + \mathbf{u} \cdot \nabla \mathbf{u} = -\nabla p + \frac{1}{Re} \nabla^2 \mathbf{u}$$

 $\nabla \cdot \mathbf{u} = 0$

To predict phenomena, we have to be able to solve PDEs!

____ That is a hard problem. We will harness computers to help! Let's build up in stages.

How will we approach numerical methods?



This is our roadmap for the semester!