

## Project 1 [6 FP “Fluency Points”]:

### *Model the Vibration of a Bending Structure*

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#### Description:

Accurately model the "transverse vibration" of a real-life structure that undergoes small bending, e.g., a metal ruler, racket, etc., using continuous systems theory. Derive an equation of motion for the vibration, complete with numerical values for all constants.

- Choose any real-life structure or beam that vibrates transversely (i.e., bends)
- Take a few pictures of the vibrating structure, including a selfie showing the structure
- Model the vibration of the structure by:
  - making and justifying assumptions
  - constructing a *structural model*, i.e., modeling the structure as a continuous system (infinitely deforming beam)
  - sketching a *vibration model*, i.e., mass-spring-damper system
  - sketching an FBD and ID
  - deriving an EOM (2nd order ODE)
  - bringing numerical values into the EOM
  - and reflect on your learning and personal journey of working on this project

#### Deliverable:

Present your work in a written technical memorandum (i.e., concise report). All content must be typed, except for sketches and equations where handwritten work may be included.

#### Rules and Formatting:

- This is an individual project, to be done by you and you alone
- The tech memo must include the following sections at a minimum:
  - Cover page
  - Introduction
    - Background and description of the project, learning goals, etc.
  - Methodology
    - Experimental strategy or plan, instruments used, photos of setup, assumptions, theory/physics involved, formulation, etc.
  - Data collection/research/lookup, calculations, and result discussion
  - Conclusion
    - Any insight gained regarding the technical content of your work; improvement recommendations, experimental or theoretical limitations, errors involved, etc.
  - Reflection
    - *Your own* learning journey while working on this project; discovery about your

learning style, strengths and weaknesses; discovery of your surroundings; your worldview, etc.

- References where applicable
  - Choose any citation style (tho' IEEE style is popular in engineering writing)
- There's no requirement of minimum or maximum number of pages
- Your tech memo must be in the “vertical flow” orientation, i.e., not requiring the reader (Dr. Siow or the TA) to rotate their head

Submission:

Submit your PDF on Gradescope only. Submissions by email or other means will be disregarded.

Due on Sept 20, 2021 (Monday), at 11:59 pm CST.

Late submissions will be subject to the “half-life” reduction policy according to the syllabus.

Grading Rubric:

	Fluency			Scaling	Max Possible
	2	1	0		
<b>Technical Rigor</b>	Assumptions are reasonable and not oversimplified; physics, math and data are accurate and convincing	Some obvious details missing	Farfetched, or missing most details	1	2
<b>Professionalism</b>	Presentation of work is logical, legible, and easy to follow; format is well-structured; free from grammatical or typographical errors; a joy to read	Some obvious issues with coherence and/or format	Full of errors; hard to follow; illegible	1	2
<b>Rationale, Justification, Reflection</b>	Thoughtful and authentic; acknowledges limitations/inaccuracy and suggests future (self-)improvements	Insubstantial or vague	Missing altogether	1	2
<b>Max Possible:</b>					<b>6</b>