Project 1 [7 FP “Fluency Points”]:

Model the Vibration of a Badminton Racket Accurately

Description:

Model the vibration of a real-life structure – a badminton racket – using continuous systems theory. Capture as much physics as possible.

- Watch this YouTube clip
- Model the vibration of the racket in the video by:
  - making reasonable assumptions
  - constructing a *structural model*, i.e., modeling the racket as a continuous system (infinitely deforming rod/beam/shaft)
  - sketching a *vibration model,* i.e., mass-spring(-damper) system
  - sketching an FBD and ID
  - deriving an EOM
  - bringing as many numerical values as possible into the EOM
  - and, finally, reflecting on your work

Deliverable:

Present your work in a handwritten (and hand-sketched) format, digitized as PDF, JPG or PNG.

Rules and Formatting:

- You must sign and date at the bottom of each page of your work
- If you have more than one page (or more than one file), you must also put a page number at the bottom of each page
- There's no requirement of minimum or maximum number of pages
- Your digitized work must be of sufficient resolution and quality
- Your digitized work must be in the “vertical flow” orientation, i.e., not requiring the reader (Dr. Siow or the TA) to rotate their head
- Each page of your submitted file (PDF, JPG or PNG) must be associated with the Gradescope “question” for this project
- Violation of *any* of these rules will invalidate your submission altogether – seriously, read this document carefully!

Submission:

Submit a PDF (any number of pages) or any number of JPG/PNG files, on Gradescope. Submissions by email or other means will be disregarded.

Due on Feb 8, 2021 (Monday), at 11:59 pm.

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

Grading Rubric:

	Fluency		Scaling	Max Possible
	1	**0**		
Assumptions	Reasonable; sufficiently reflect real-world physics	Oversimplified; some important considerations are missing; or missing assumptions altogether	1	1
Structural Model	The structural element(s) is clearly defined, and represents the actual physics well; consistent with assumptions made	Incoherent with assumptions made; important details are missing; or missing a structural model altogether	1	1
Vibration Model	The mass-spring(-damper) sketch is clear and consistent with the structural model and assmptions made	Incoherent; important details missing; or missing altogether	1	1
FBD & ID	Well sketched, with each force and acceleration clearly defined	Incoherent; important details missing; or missing altogether	1	1
EOM	Derivation is mathematically sound	Obvious issues with the math; or missing altogether	1	1
Numerical Values	All numbers (for m, E, ρ, etc.) are in reasonable order of magnitude and are based on assumptions; data sources are clearly referenced	Numbers are arbitrary or random; inconsistent with assumptions; no sources are cited; or missing altogether	1	1
Reflection	Thoughtful and authentic; acknowledges limitations/inaccuracy and suggests possible future improvements	Insubstantial; vague; or missing altogether	1	1
			Total	7