MECH 545
Summer 2025
Final Project Proposal Assignment

The intent of your final project is to apply some of the concepts of structural analysis to your research or a topic of interest. This is in an effort to help you practically apply and internalize those concepts. This final project will take the place of the final exam described in the syllabus.

The first deliverable will be a proposal for this project. This proposal will be due in class and digitally on Friday, 11 July 2025. This is to allow you time to discuss with your advisor and the course instructor. This proposal will count for 5 points of the 25 points that are assigned to this project. The intent of this proposal is for you to nail down your topic and allow me to help you ensure the scope of your project is appropriate. Your final project will include a presentation and report each worth 10 points.

Your work should include calculations of structural analysis. Then, these calculations should be compared to some reference, such as finite element analysis, experimental results, or real-world results. Your work may be heavy on finite element analysis, but must include some fundamental calculations as well. Depending on your topic, you will likely need to find analytical calculation methods from sources outside this course and recommended course text.

As an example, as an AFIT student, I needed an estimate of the failure stress of the samples I was planning to manufacture. Using some basic calculations, I was able to build a Matlab code that provided a predictive failure load for any layup sequence. For comparison and validation, I referenced different but related experimental results from other researchers.

For a second example, in the same samples, I had materials with vastly different thermal expansion coefficients. We needed to know how important considering this mismatch was to the manufacturing and predictive modeling effort. I found a text on fiber metal laminates with a set of equations to predict thermally induced stresses in similar materials. I was able to compare these calculations to a fairly simple finite element model.

Details for your proposal:

- Your proposal will likely be on the order of 1000 to 2000 words in length.
- Answer the following:
    - Describe the background of the system you are analyzing.
    - Why is there interest in this topic? If it feeds your research, explain how.
    - What type of analysis/calculations do you expect to perform?
    - What assumptions do you expect to make?
    - What do you expect to use for comparison (Finite Element Analysis, experimental results etc) and how do you expect to implement this comparison?
    - What type of conclusions/outcomes do you expect? I.e., determine to what extent you should consider thermally induced stresses as your research progresses.
    - List any expected references. Provide at least 2.
- Your digital document may be in word or pdf format. I.e., do not submit something in LaTeX.
- Your submission may include figures, but they are not required.
- Be sure your name is in the file name of the digital submission.

Other Considerations: I would also consider topics involving topology optimization or design optimization as long as fundamental calculations could be performed and appropriate comparison made.