Honors Contract for MTH 280-01
"Module to Calculate Stress, Strain, and Torsion of Loaded Beams and Trusses"
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1. What is your project? How will this project differ from the regular class work?

This project will focus solely on creating equations needed to calculate stress, strain, and torsion. Knowledge will be applied from Mechanics of Materials class, CEN 202, and more research will be done to understand how each equation in real life would work. this knowledge would then be applied to create specific equations in a module. I will compare how user-friendly and accurate my equations are to other developed modules with similar equations. Lastly, I will also create 2D models showing how the internal forces would look like if the beams were cut.

Introduction to Scientific Computation (MTH 280) focuses on computational skills and being able to use those skills to solve varying problems throughout the semester. This project will instead make me focus on specific areas of loading on materials and how they can affect the materials. For example, I will have equations output the stress of a loaded beam and then also output if this would be above a certain yielding point of the material, which would make the material either bend, stretch beyond a certain point, or fail completely. I will also present to the class to explain how the equations were put together and how they could be applied in the real world.

2. Why is this project important to your honors experience?

My project will allow me to study in greater depth the relationship between stress, strain, and torsion, which are fundamental, yet important material properties. I will be programming important equations used universally in civil engineering, which could be beneficial to any later research within my field of study, including for my honors thesis. In addition, this project will allow me to develop greater programming skills, which will be extremely beneficial not only to the rest of my college career but also afterwards while working in the engineering field. I will also compare my finished module with other modules used to calculate the same stresses and strains, which would allow me to calculate if there is any error in my work and how user-friendly the equations in my module are in comparison to other modules.

3. What is the final product, and how will it be achieved?

My finished product will be a Python module with mathematical equations to calculate stress, strain, and torsion of certain materials based on varying loads. The load will be the input to each equation as well as how offset the loads are from each x y and z-axes.
This will be accomplished through the timeline given in the next question. I will review knowledge gained from my mechanics of materials class, and then I will spend more time researching the affects of loading in different axes. I will then start the processing of making equations to calculate stress, strain, and torsion of different materials, one at a time, and using them to calculate known values such as Young's Modulus, which is a constant ratio between stress and strain of materials up to a certain loading.

4. Tentative Schedule of when the project will be complete is as follows:

Week of February 13th and 20th:
Research into how modules are compiled and stored properly to allow access from the command line/shell. Also, research Abaqus files and how they might relate to this project.
Code Stress and strain equations of a steel beam before reaching yielding point. Find and use ASTM (American Society for Testing and Materials) data points to confirm equations print out the correct stresses and strains.
Weeks of February 27th and March 6th:
Extrapolate previous equations to be used for multiple beam members, such as in trusses. Use data points from ASTM to confirm functionality of equations. Use Jupiter Notebook.
Week of March 13th:
Spring Break
Week of March 20th:
Status of Project: A 5-7-minute presentation of the basic principles of stress and strain, and a quick demo of the codes.
Week of March 27th:
Code torsion equation for a steel beam, and use base points to test functionality of equation.
Week of April 3rd and April 10th:
Extrapolate torsion equation to be used for triangular trusses and members using Jupiter notebook.
Week of April 17th:
Create a 2D model of internal forces acting on a beam
Week of April 24th:
Create a 2D model for internal forces acting on multiple beams.
Week of May 1st:
Short presentation.
Note: This schedule assumes I will spend about 2-3 hours per week on the project

5. What are the criteria for how the project will be evaluated? Will it be graded? If so, what percent of the course grade will be reflected by the project? If not, what are the minimum requirements that the project must meet to be judged as acceptable?

Completion of this project will be evaluated based on functionality of the equations and the fact that they can accurately measure what they intend to. A large part of grading will also be in the comments of the coding, which would allow any user, with or without previous knowledge of strain, stress, or torsion, to be able to read and understand the function of each piece of code. This honors project will be based on a pass/fail basis. If the equations are accurate, are relatively easy to use, and if the coding itself can be read and understood by most users (at the discretion of Professor Field), then the project will be designated with a passing grade.

6. If the project is unsatisfactory, will it result in a lower course grade?

No, it will not. If the project is deemed unsatisfactory, I will not receive an honors designation for the course.