PROJECT 1

Assigned TBD

Due TBD, end of day (11:59 PM).

Overview:

For this project you are responsible for approximating the behavior of an axially-loaded tapered bar using finite element analysis.

Components:

- 1-D Shape Functions
- Gauss Quadrature
- Discretization and Assembly

Overall Tasks:

- Develop a MATLAB program that can obtain the finite element solution for stress and strain within an axially-loaded tapered bar for your assigned geometry and loading conditions.
- Using a modified APDL script, compare the results for your nodal displacements for a case with three linear elements.

Deliverables:

Upload the following files to ELC:

- PDF file containing the following items:
    - Clearly defined inputs for your tapered bar. This includes:
        - Area function (A(x)).
        - Bar dimensions (L)
        - Stiffness (E)
        - Boundary Conditions (u(0), σ(L)).
    - Plots of the results. These may include:
        - Nodal displacements (both MATLAB and APDL)
        - Stresses (MATLAB)
- Original MATLAB scripts used to produce the results.
- APDL script (.txt) used for comparisons.

6350 Assignment:

- Verify that your code is working correctly using the method of manufactured solutions. This will require the addition of a body force b(x) to the script.

Grading:

Goal	Points
MATLAB script exactly matches APDL predictions for nodal displacement using three linear elements. The cross-sectional area should be a linear function of x.	**--/70**
Stress post-processed from nodal displacements within MATLAB.	**--/10**
MATLAB script supports quadratic elements.	**--/10**
MATLAB script modified to predict the displacement using 3, 6, and 9 linear elements and the change in the displacement of the unfixed end is compared between each case.	**--/10**