

ME 712 Lab 1: 3-Dimensional Frame/Truss

Element Code Due May 16

1. Write a finite element submodule
 - (a) Write a general element code to generate the elemental stiffness and mass matrices for a single three-dimensional rod/torsion-rod/beam linearly tapered element for WFEM.
 - (b) Write an additional routine that returns the coordinate transformation matrix.
 - (c) Obtain the FE matrices (M and K) in global coordinates.
 - (d) Write a subroutine to assemble these elements into the global matrix.
2. Check your code by comparing the results of your code to that of ANSYS for a sufficiently complex problem. Be sure to do at least one mesh convergence study in addition to the following bench marks (See 3 below).
 - (a) Static simple and complex (complicated)
 - (b) Dynamic theoretical: compare to closed-form dynamic mode shapes and natural frequencies
 - (c) Prove that choice of coordinate does not change your answers through rotating your problem a partial angle (less than 90 degrees in all three directions.).
 - (d) As least one dynamic case unique to your group validated against ANSYS.
3. Reports should show tables comparing continuum theory/ANSYS/your code results for numerous validation cases. Dynamic cases must also show convergence to continuum theory when the mesh is refined for both rod, torsion rod, and beam cases. The more validation that is performed, the higher your work will be regarded. Put code and transcripts in an appendix.
4. All reports and codes and input files must be zipped and emailed to me in a single package.