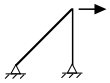
M.E. Plesha
9/18/14

EMA 605 Semester I, 2014-15
PROJECT – OPTION #1

Using the language of your choice (e.g., Fortran, C++, MATLAB, Mathematica, etc), write your own FE code for bars in 2-D. Your code should have the capability of treating up to 50 nodes, 100 elements, and 5 material sets. In your code, it is recommended that you store the entire stiffness matrix. For the various tasks in your program, you may use the coding reported in CMP 3e. For example: for element assembly you may use coding similar to Fig. 2.7-4 of CMP 3e; for equation solving you may use the simple Gaussian elimination subroutine in Fig. B.2-2 of CMP 3e (if using Fortran, make sure the row dimension matches that in the main program). Anywhere your program uses code from CMP 3e, your program should give appropriate citation and credit to the source.

Use your program to analyze the following models.

Model 1: Analyze the 2-D truss example problem considered in lecture to determine the deflections and stresses.



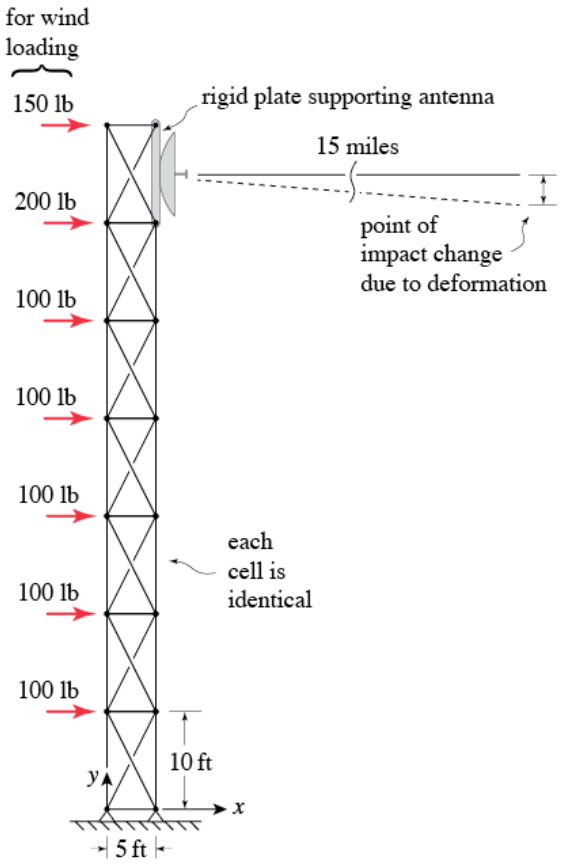
Model 2: A steel structure supporting an antenna is shown. The antenna is targeted so that it's "point of impact" is at a specific (roughly horizontal) location 15 miles away. Determine how much the point of impact moves relative to the target due to the following separate load cases:

1) Loading due to wind which is idealized by the forces shown on the left-hand portion of the structure.

2) Thermal loading of material given by $T(x) = 30°\text{F}(1 - x/5\text{ ft})$ where x is a coordinate measured in feet as defined in the sketch.

Vertical members have CSA = 0.823 in^2
All other members have CSA = 0.425 in^2

$E = 29 \times 10^6$ psi
$\alpha = 7 \times 10^{-6}$ / °F



Report: Write a report that presents the key results for your two models. Your report should convince the reader that you have accurate results. The report should include a sketch showing node and element numbers on the structure, and a sketch of the deformed structure shape.

Your report should include appendices with:

- A listing of your program.
- A listing of your output for each model.

Writing tips: Your report should be typed (figures can be neatly drawn by hand) and should be easy to read. It should have correct spelling and punctuation, and have important results summarized. The reader should not have to sift through your raw finite element output to find maximum deflections and stresses, or to determine the deformed structure shape, etc.

Expectations for your work: It is acceptable to discuss this project with your peers, but you are expected to do all of your programming and analysis independently. You are allowed to use the coding providing in CMP 3e (cite where you do this in your program). You are not allowed to use coding from the internet or any other sources. This project is a substantial portion of your course grade, and a commensurate level of independent and original work is expected.

Important dates:	Assigned	Thursday, Sept 18.
	Progress Report due:	Thursday, Sept 25.
	Final Report due:	Thursday, Oct. 16.

Progress report: Simply state what language you will use for your program. By submitting this progress report, you are also committing to do Option #1.

Grading:

70% Does your code work and do you get correct answers?
30% Quality of your report.

Projects will accepted up to one week late (for a 10% reduction of grade)