Missouri University of Science and Technology

Structures II: Final Project

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December 13, 2015

1 Editing Solver Code

The edited code is available in the github repository found at:

https://github.com/rjk9w5/FEM_project.git

β	E [GPa]	% error
0.2	14.48	79.31
0.5	27.67	60.48
1	39.23	43.95
2	50.64	27.65
5	60.71	13.28
10	65.02	7.119

Table 2.1: Tabulated Results for Calculated Young modulus

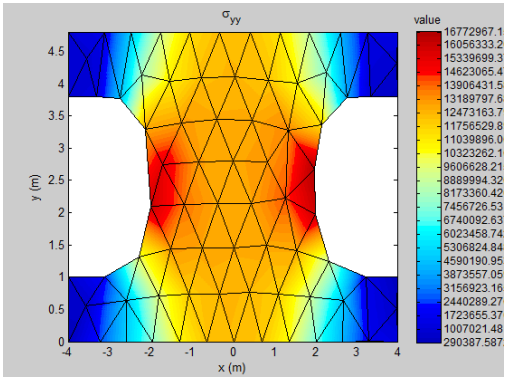
2 Dog-Bone in Uniaxial Tension

The Young modulus (E) was calculated for various lengths of L where $L = \beta A$. 'A' is a constant, and β was varied as 0.2, 0.5, 1, 2, and 5. The actual Young modulus was 70 GPa. The results are tabulated in table 2.1 and shown graphically in fig. 2.2a and 2.2b.

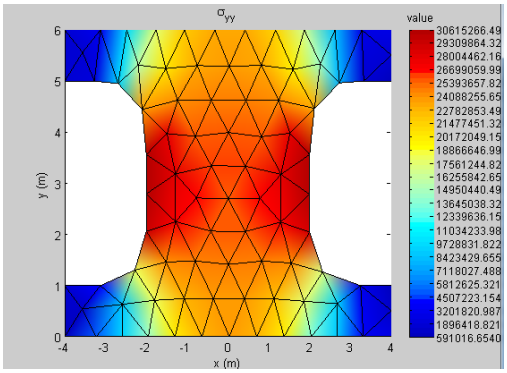
It can be seen that the Young modulus is within the desired tolerance when the length is 10x the cross-sectional area.

The reason an error occurs in the calculation of the Young modulus is a result of the numerical errors from running the simulation. The longer the dog-bone specimen becomes the closer it matches the assumption of a uniform width rod that is used for calculating the Young modulus in the first place.

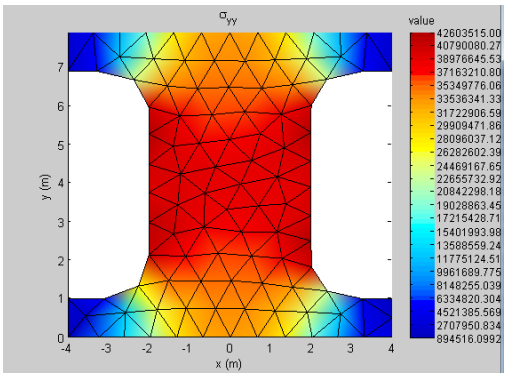
3 Flat Plate with a Hole



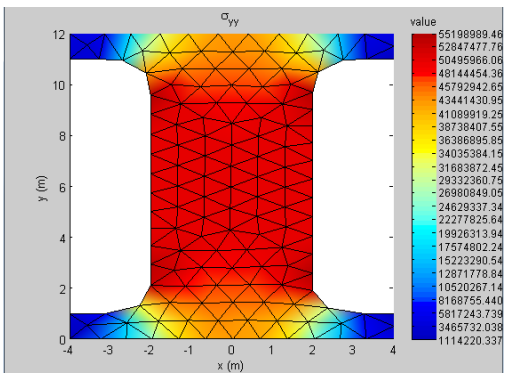
(a) $L = 0.2A$



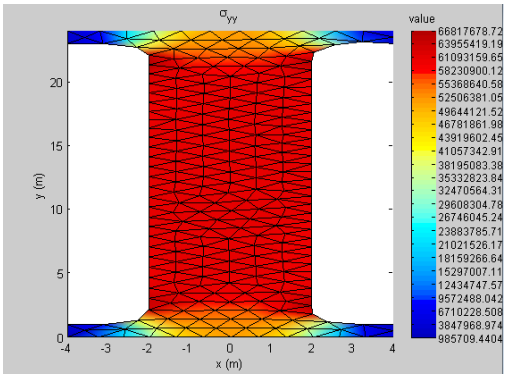
(b) $L = 0.5A$



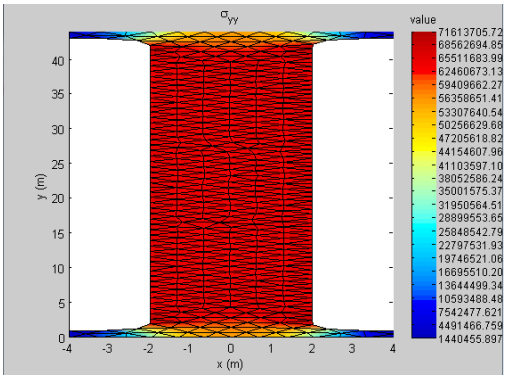
(c) $L = 1A$



(d) $L = 2A$

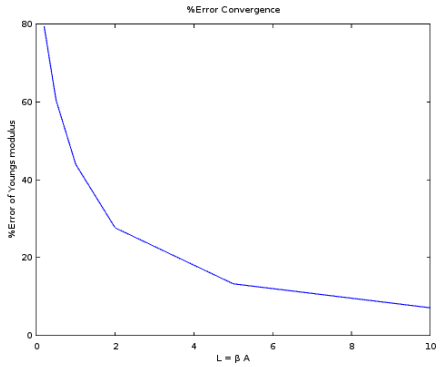


(e) $L = 5A$

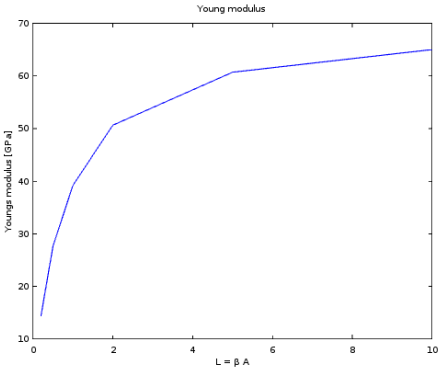


(f) $L = 10A$

Figure 2.1: Stress Distributions for each Iteration



(a) Plot of %error of calculated Young modulus



(b) Plot of calculated Young modulus

Figure 2.2: %Error and value of apparent Young modulus versus gage length