

redAnTS 2 - Post-Process the Solution

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Problem Specification

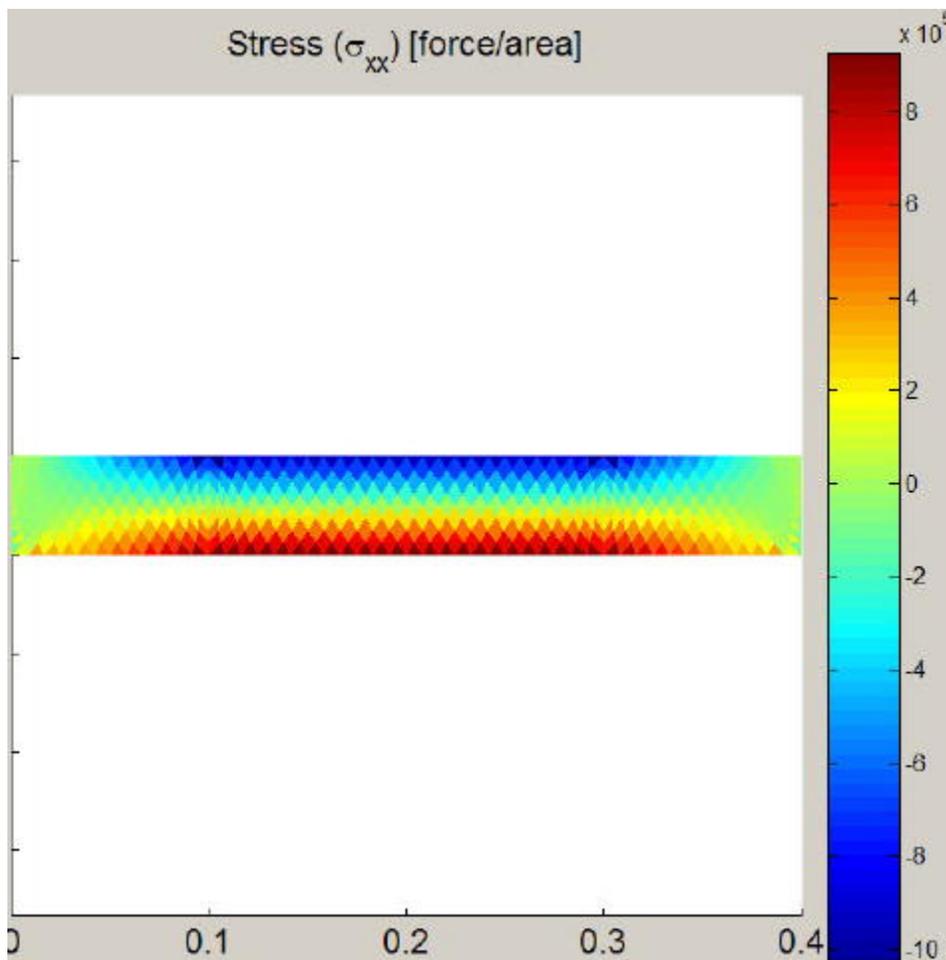
1. Start-Up & Preliminary Set-Up
 2. Generate Finite-Element Model
 3. Specify Inputs
 4. Assemble and Solve Global System
 5. Post-Process the Solution
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Post-Process the Solution

To calculate the stress and strain components, click on [Strain](#), [Stress](#) under [Post-Process](#).

Plot σ_{xx}

In the [Plotting](#) menu, select [Stress \(xx\)](#).



We expect a pure bending stress in the central region between the two applied forces. The stress is tensile on the bottom surface and compressive on the top surface as expected. Elementary beam theory predicts the bending stress as $\sigma_{xx} = My/I$. Here

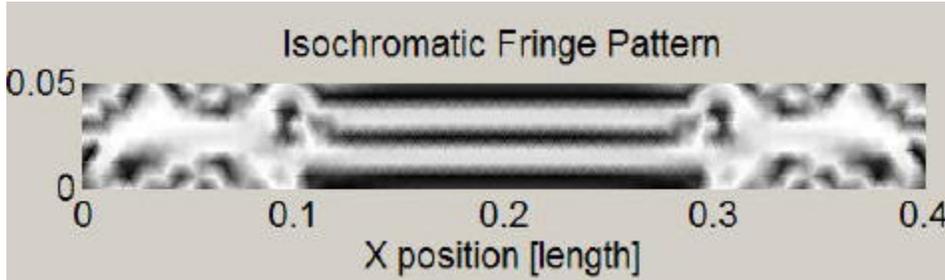
$$M = 4000 \cdot 0.1 = 400 \text{ N m}$$

$$I = bh^3/12 = (1) \cdot (0.05)^3/12 = 1.04e-5 \text{ m}^4 \text{ (assuming unit thickness in the z direction)}$$

For this geometry, we expect the neutral axis to be at $y = h/2 = 0.025$ m. So the max value of $\sigma_{xx} = M \cdot (h/2) / I = 9.6e5$ Pa. This is reasonably close to both the maximum value of tensile and compressive stresses from the computational solution. We have a relatively stubby beam; the agreement with beam theory should improve as the length/height ratio of the beam is increased. Also, the FEA solution perhaps can be made more accurate by refining the mesh. This is left as an exercise to the reader.

Plot Isochromatic Fringes

In the **Post-Process** menu, select **Isochromatic Fringes**. This calculates the fringes. To plot the fringes, select **Isochromatic Fringes** in the **Plotting** menu. For the number of fringes, enter 5.



Since elementary beam theory predicts that the bending stress is proportional to y for constant bending moment, we expect lines of constant y in the middle region to have the same bending stress. This is confirmed by the horizontal fringes in this region. Note that in the vicinity of the applied point forces, the fringes become horizontal bands in a distance that is much less than the beam height. This indicates that the effect of the applied forces is very localized. Thus, the stresses in the pure bending region are insensitive to how the applied moment is produced; the bending stresses will not change if one replaced the current loading with a statically equivalent case that produced the same bending moment in this region.

Export Data

To save all the data in the workspace, select **Workspace** in the **Export** menu. Specify `beam.mat` as the filename and click **OK**.

This brings us to the end of this exercise. Goodbye!

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