Educational resources for blended learning in structures

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Engineering education: is there a problem?

- It has long been acknowledged that there are areas within Structural Mechanics that students find difficult.
- Many call for a reform in engineering course content.
- Arguments both for and against traditional lecture format of education courses versus courses based around design projects and hands-on experience.
- The key is to find a balance.

Educational theory

- There are many definitions and discussions surrounding theory such as ‘active learning’ and ‘blended learning’.
- These often argue that one method should be used instead of traditional teaching or other methods.
- It is best to have a repertoire of methods to use in the hope of successfully teaching a majority of students.
- When educational ***‘theory is translated into an instructional prescription, exclusivity is the enemy of success’*** (Sfard, 1998).

Research – Student Interviews

- Interviews and discussion groups were carried out with current third and fourth year students to ascertain the areas of most difficulty within the first and second year of the Structural Mechanics course.
- The most common concepts were stress and strain, particularly in the Solid Mechanics module.
- The biggest problem was visualising what the theory represented physically.

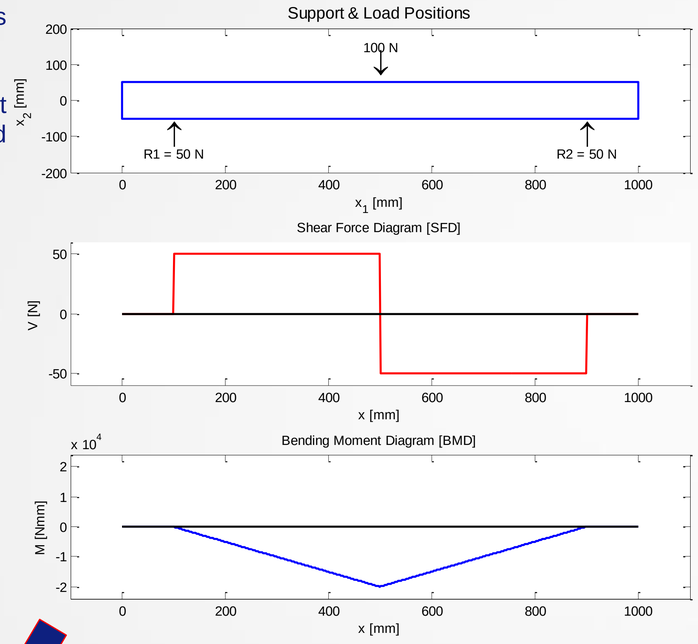

Figure 1: Loading, shear and bending for a 1m long beam with a central point load

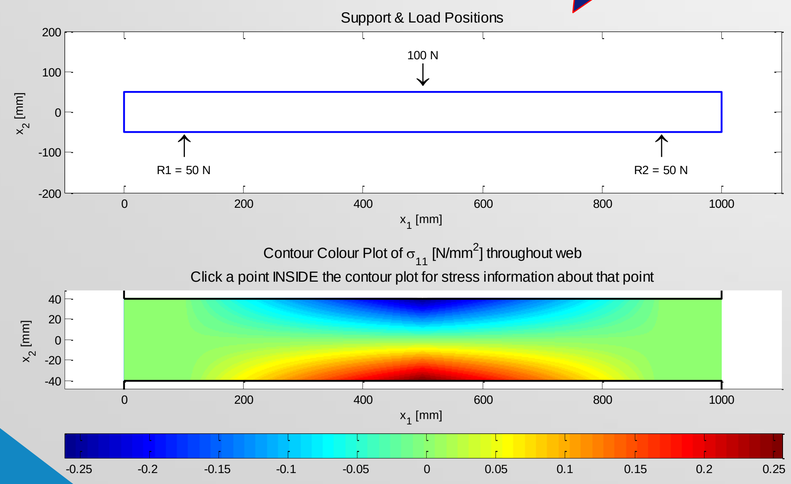

Figure 2: A contour plot of normal stress within the web of the beam

Developing a resource

- Owing to the problem of reduced contact time a computer-based resource to assist learning in Solid Mechanics was envisaged.
- Initially this took the form of a Matlab code that worked through the tutorial sheet currently used, providing feedback and assistance to students. However, this was deemed unsuitable as a usable resource.

Matlab Tool

- Tool to address problem of visualising theory in Solid Mechanics physically.
- Allows the user to explore the stresses within a simply supported I-beam.
- The cross-section of the beam, the support positions and the quantity, magnitude and position of the loads are all user defined.
- Figures 1, 2 and 3 show the main outputs of the tool. The user can repeatedly move between the contour plot and the Mohr’s Circle to explore the stress at different points.

Further Development

- At present, the tool can only be used for a simply supported beam with a number of point loads.
- This could be expanded to statically indeterminate loading situations through the inclusion of more supports and distributed loads.
- Careful consideration is required before including more complex situations as this could cross the boundary between being an educational tool or more sophisticated structural analysis software.

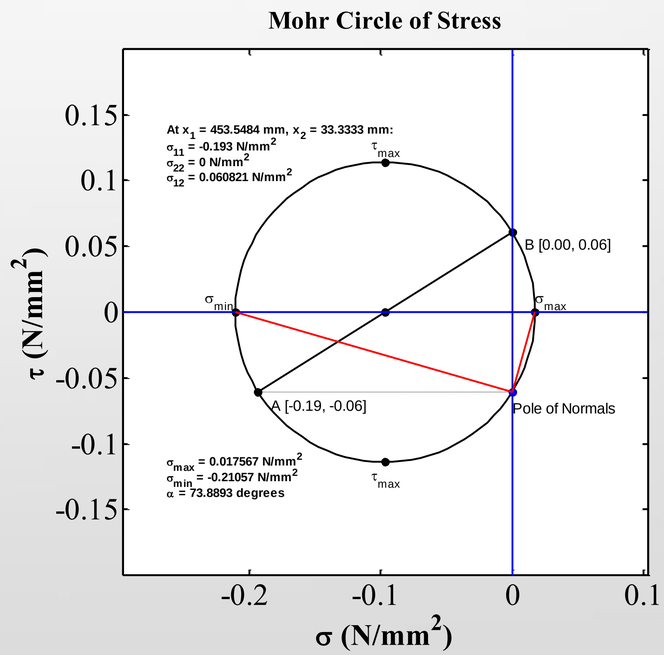

Figure 3: Mohr’s Circle of Stress for a point in the web selected from the contour plot

References

- Sfard, A. (1998) On Two Metaphors for Learning and the Dangers of Choosing Just One. *Educational Researcher.* 27 (2), 4-13.

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