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University of Nebraska Lincoln

The Impact of Using Computer Models on Academic Performance of Engineering Students

Presented by:

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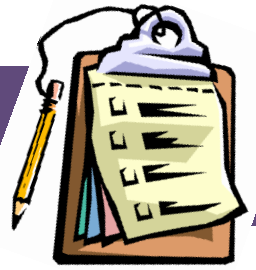
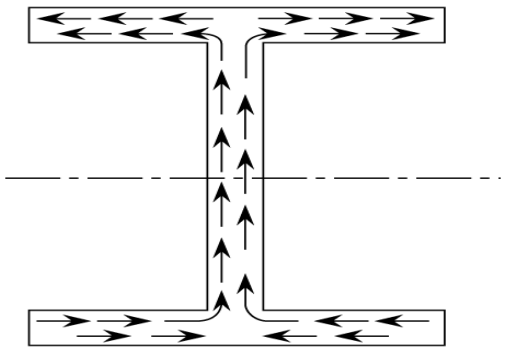
Agenda



- Problem Statement
- Computer models
- Research Objectives
- Research Methods
- Results and Discussion
- Conclusion

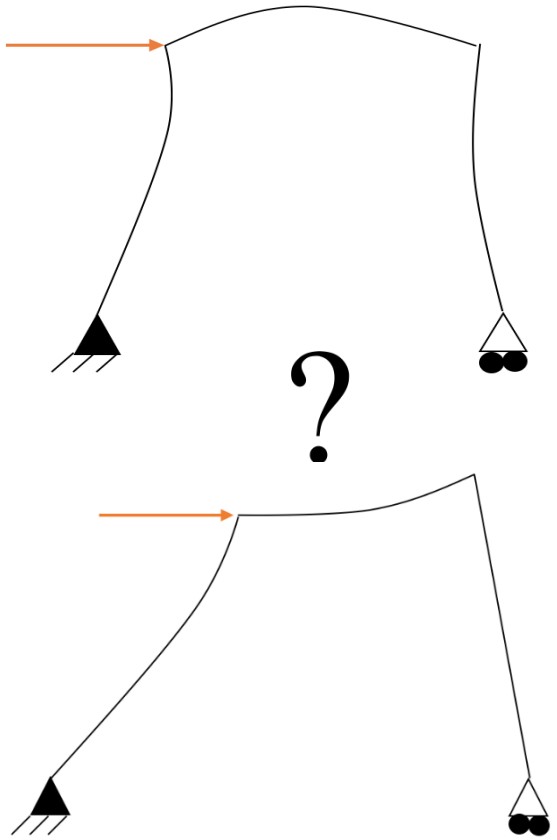
Problem Statement

- Being able to conceptualize physical concepts are essential for engineering students:
  - ✓ First step to solve any engineering problem is about conceptualization, not solving the equations.
  - ✓ Engineers should be experts in utilizing physical concepts in human construct designs.
  - ✓ Critical thinking needs an in-depth understanding of physical concepts in any problem.



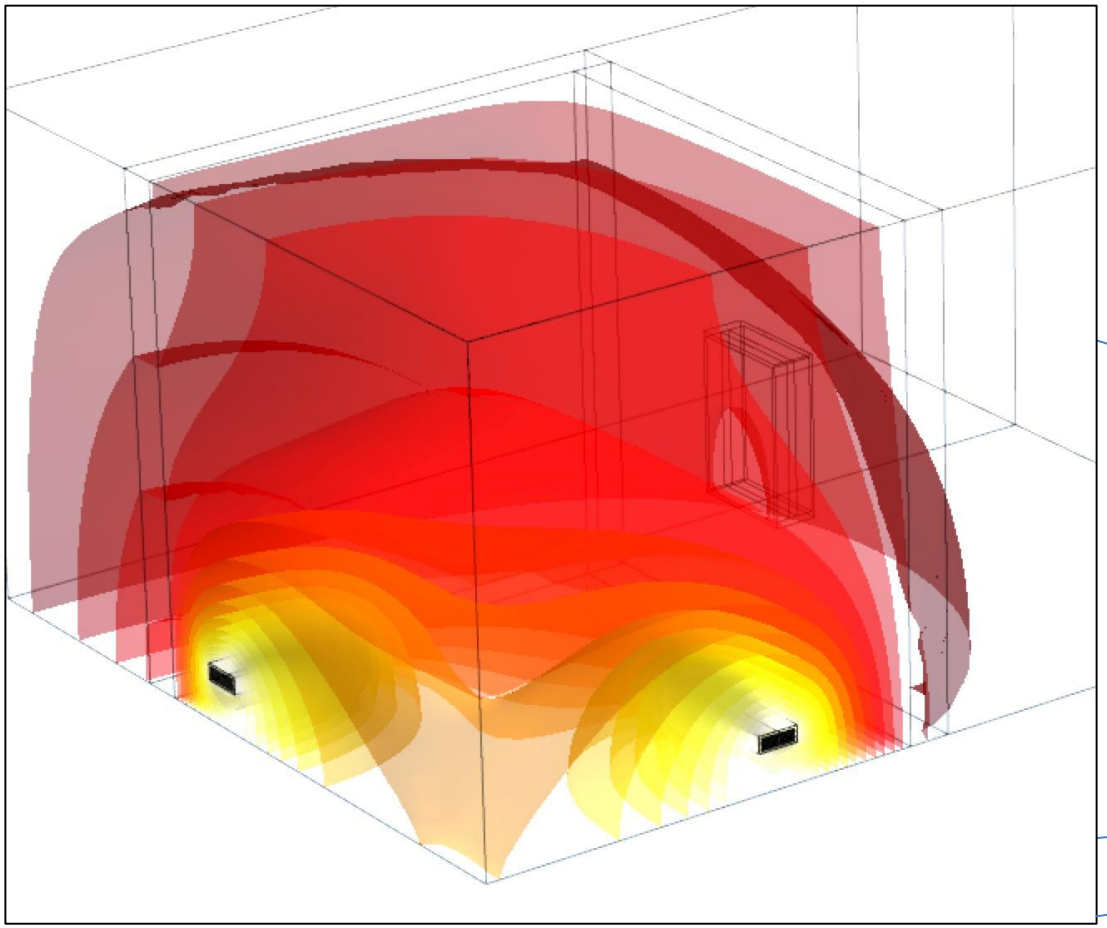
Problem Statement

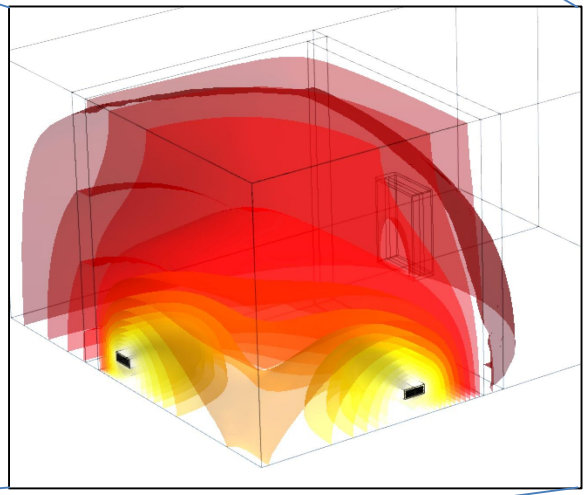
- Conceptualizing physical concepts are hard for engineering students:
  - ✓ Many physical abstract concepts such as stress, strain, radio wave, temperature, flow lines, etc. are not observable in the real world.
  - ✓ Not all the visualization capabilities of students are the same.
  - ✓ Abstract concepts



Computer models

- Why computer models?





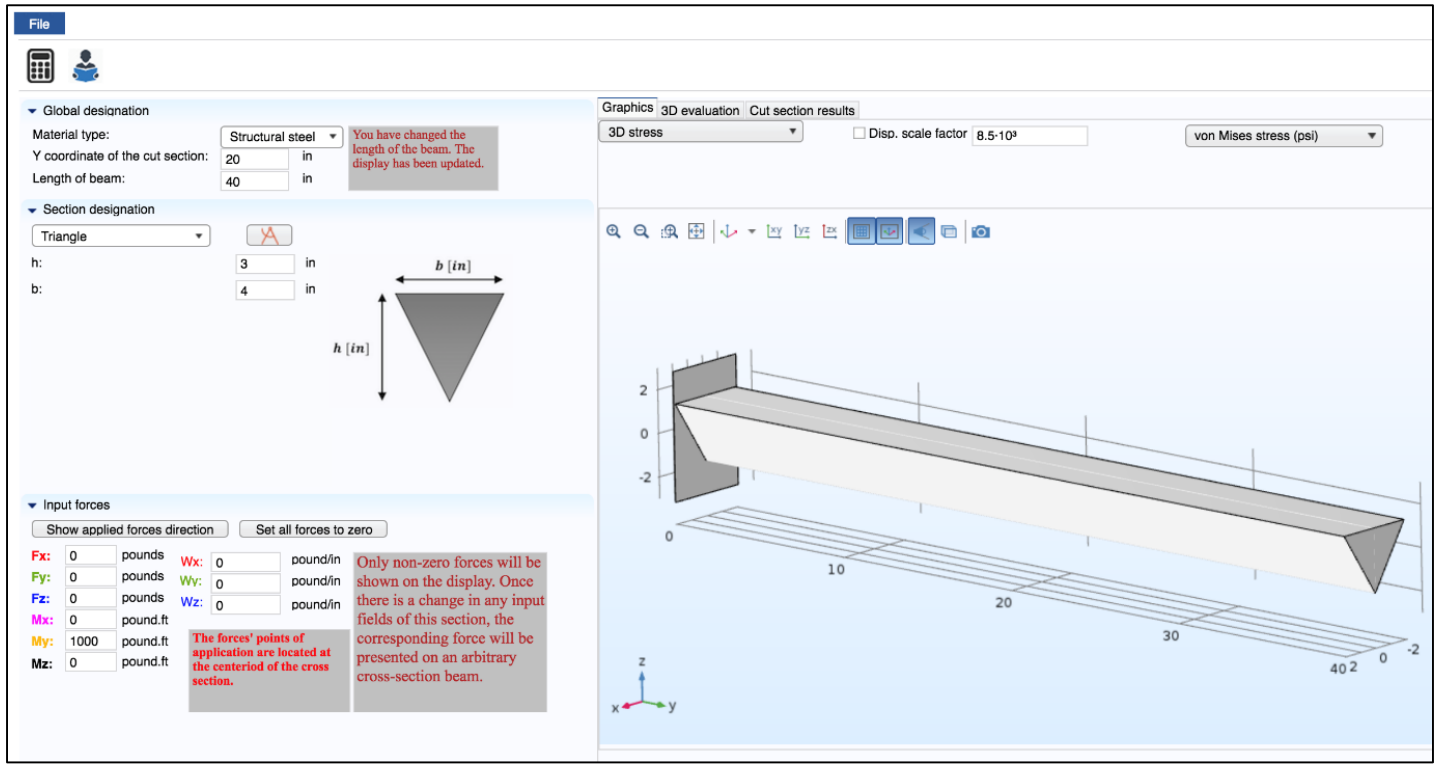
Computer models

- Potentially, by using computer models, students can:
  - ✓ Understand the fundamental concepts of the course better.
  - ✓ Compare the results of their own calculations with the ones provided by the models.
  - ✓ Think differently, out of the box, in approaching the solution of the problems.
  - ✓ Develop a better critical thinking capabilities by observing a replicate of the real-world scenario.

Research objectives

- Increasing engineers' conceptualization and pedagogy level by using computer models.

- Optimizing/developing the application model by monitoring how the students work with the application model.

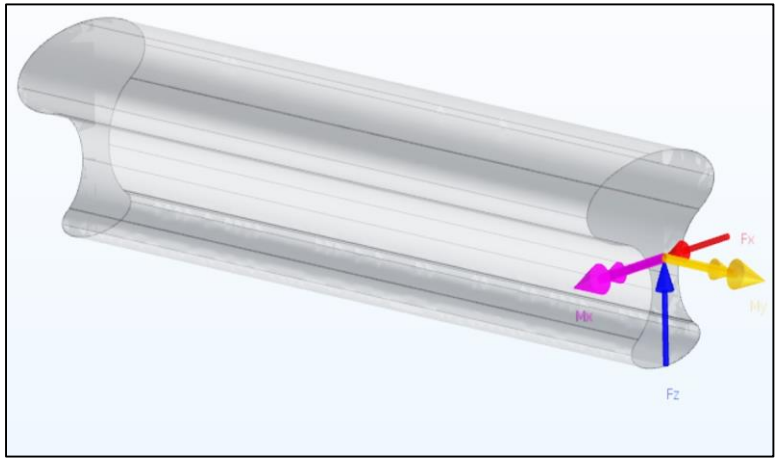


Research Methods

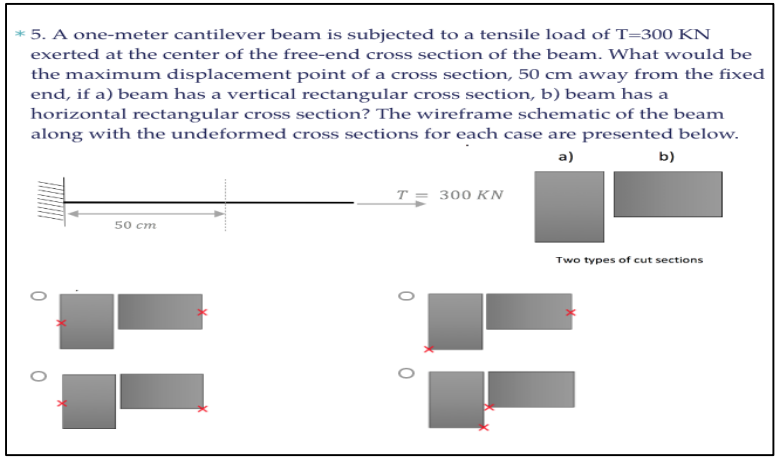
- ✓ Participants: engineering college students, are divided into two groups, and asked to take the online test comprising ten conceptual problems pertaining to solid mechanics, one group having access to the model and the other group with no access to the model.
- ✓ First group is using the model, their work will be recorded.
- ✓ Results of the two groups will be compared statistically .
- ✓ Setting all other influential factors to zero, we can find if there is a meaningful difference between the two groups' performance in terms of solving structural problems.

Research Methods

- Model:
  - ✓ Using COMSOL multi-physics, a 3D multi-section cantilever beam model was developed to display deformation due to various forces acting on the beam and provide the corresponding moment and shear plots.



- Questionnaire:
  - ✓ An online questionnaire was developed, consists of 10 questions about different stress distributions and deformations in a cantilever beam.



Results and Discussion

- Results:
  - ✓ Potential results could demonstrate the impact of using computer models on the problem solving abilities of the students.
  - ✓ Since students can provide comments for each questions, not only the probable defects of the study design could be pointed out, but the current questionnaire and the corresponding model can be redesigned/improved as well.
  - ✓ By going through the recorded videos of students' work with the model, interesting points were observed such as the correct location of buttons, time spent on each section, and the overall usability of the model.

Conclusion

- Conclusion:
  - ✓ Findings of this study can potentially show an improvement in conceptualizing and visualizing engineering problems and their equivalent real-world replicates.

Questions

Thank you for your time.

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