AER303 – Analysis of Aircraft Structures
Research Project – Vibration of Beams

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Course Grades – Modified

- Total grades: 125
- Term work: 25 (5 attendance , and 20 Reports)
- Research Project : 100

The final grade will be either Pass or Fall.

Vibration of Beams Research Project

In the present research project, it is required to conduct a vibration analysis of a beam using

1. Exact solution (Free Vibration)
2. Approximate Lagrange and Rayleigh-Ritz Methods (Free and Forced Vibration)
3. Finite Element Method – ANSYS (Free Vibration)

This is an *individual project* in which each student must perform all the analyses himself.
Each student should select a different beam problem based on the following alternatives.

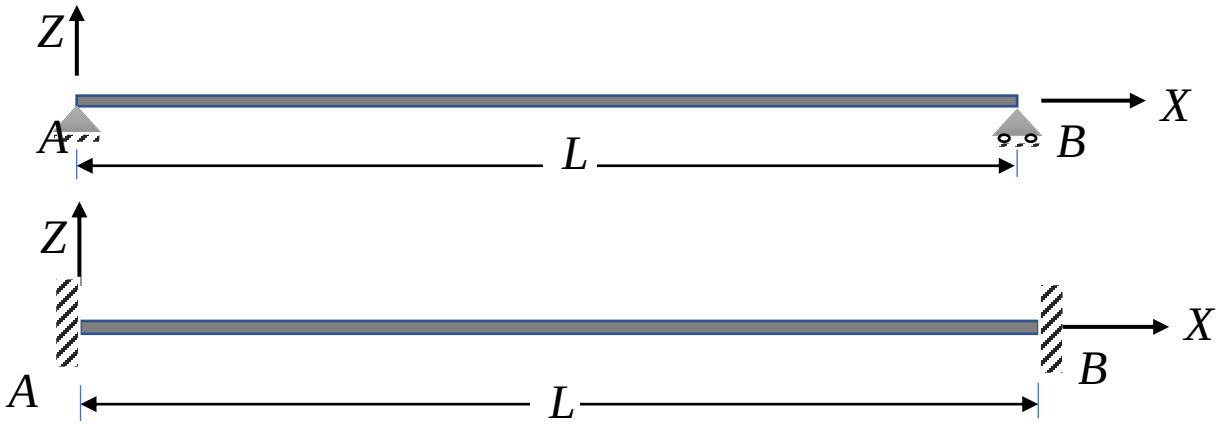
Problem Formulation – Beam Bc's

Select your beam problem boundary conditions as one of the following.

Loads:

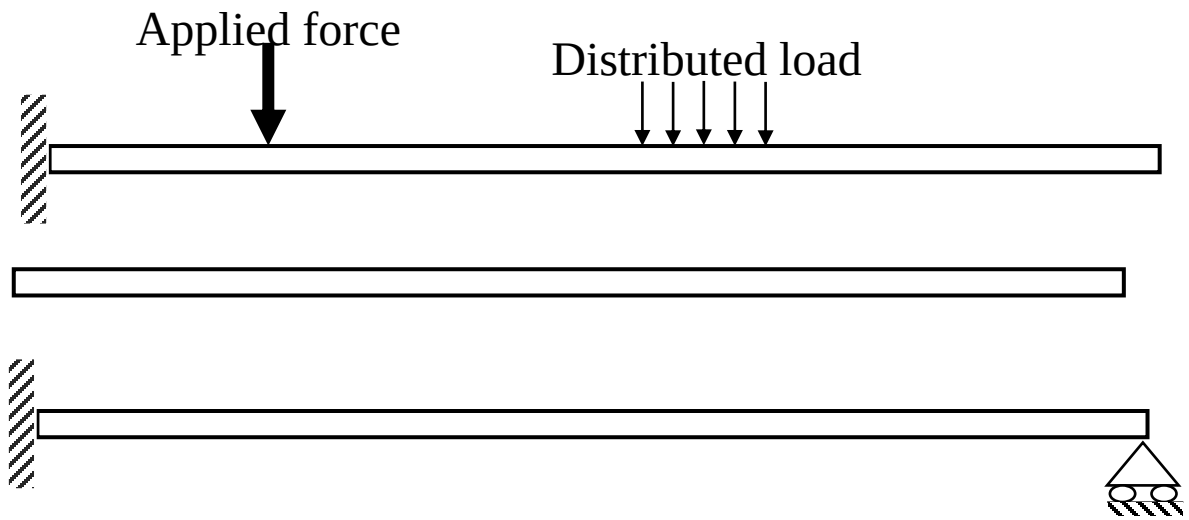
- Concentrated force
- Constant distributed load
- Linear distributed load

Each student should define the force value and dimensions himself based on his reading.



Simply supported

Fixed-Fixed



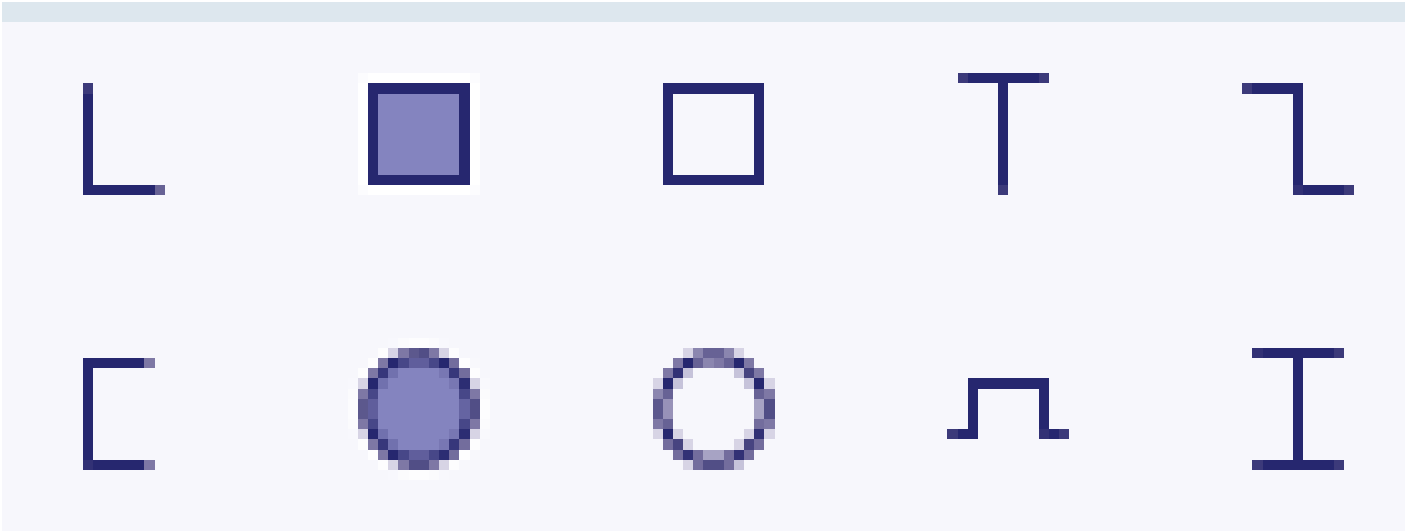
Cantilever

Free-Free

Fixed - Pinned

Problem Formulation – Beam Geometry and Material

Select the cross-section geometry as one of the following.



Materials:

- Steel
- Aluminum

You should select your beam problem based on the given boundary conditions and cross section shapes. Then define the beam dimensions yourself.

Problem Formulation

Displacement Bc's	Force Bc'c	Cross-section	Material
Simply supported Fixed-Fixed Cantilever Free-Free Fixed - Pinned	Concentrated Constant distribution Linear distribution	L-shape Rectangular solid Rectangular Hollow T-section Z-section C-section Circular solid Circular hollow Hat section I-section	Steel Aluminum

Your problem will be determined by selecting one item from each column

Problem Formulation

After you select a problem, put a title for your project based on the beam Bc's, cross-section and material you selected. For example,

Displacement Bc's

Load

"Vibration Analysis of Steel Cantilever Beam with circular cross-section under distributed load"

material

Cross-section

So, each student should have a *different problem* based on the previous instructions.

Please define the reference from which you got the beam geometric values, load values, and material properties.

Beam Vibration Analysis – Required

Each student must conduct,

1. Free Vibration analysis using Exact solution.
2. Free Vibration analysis using ANSYS.
3. Free vibration analysis using approximate solution
4. Compare between solutions in 1, 2, and 3.
5. Parametric analysis: study the effect of different cross-section dimensions (thickness and height) on the beam first three natural frequency using *Exact solution*. Plot the results (change of the three natural frequencies corresponding to the beam cross-section dimensions)
6. Forced vibration analysis using approximate solution

in free vibration analyses determine at least the *1st three natural frequencies and mode shapes*.

Deliverable

After finishing your analyses, you must submit online:

1. Project report
2. Presentation
3. Presentation with voice

Both will be submitted to my email “abdu_aerospace@eng1.cu.edu.eg “
And on google scholar (Link will be provided by the TA).
Deadline for both the report and presentation is 1-Jun 2020.

Project Report – Contents

1. Title Page (student name, section, and bench number, project title)
2. Table of contents
3. Problem Statement (Formulation)– define the beam problem in details
   - Schematic for the whole beam
   - Bc's
   - Material properties
   - Beam cross-section
4. Methods
   - Detailed exact solution
   - Finite element analysis
   - Detailed approximate solution
5. Results and discussion
   - Comparison between solutions
   - Parametric analysis
   - Comment on all the results
6. References

- You should solve the problem and write the report yourself.
- It is not allowed to copy any data from anywhere.
- The report should be clear and concise
- Use tables and figures as appropriate to clarify and summarize your results.

Project Presentation

A maximum of 7-slide presentation with voice should be submitted including the title page with these mandatory contents

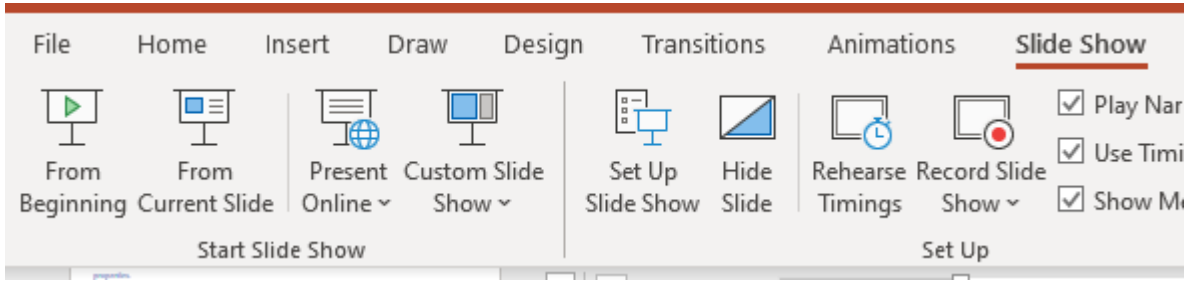
1. Problem statement (1-slide)
2. Methods (3-slides)
3. Results (2-slides)

Be concise and clear. You must prepare and narrate the presentation yourself. Use figures and tables as appropriate to clarify your results.

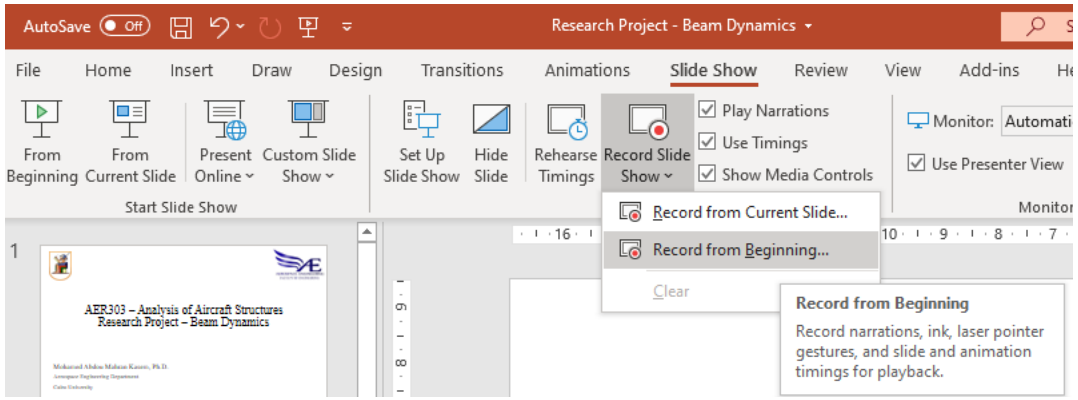
Project Presentation – adding voice

To add voice to your presentation,

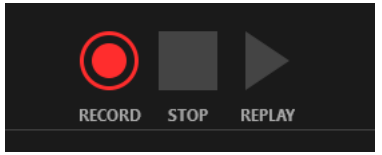
1. Select the slide show tab



2. Select record slide show – record from beginning



3. Select voice option only and then click record.



4. You can stop and start your record at any time.

Project Evaluation

Your project will be evaluated based on:

- Submit all the requirements on-time
- Report quality
- Presentation quality
- Solution accuracy
- Quality of the comparison, parametric analysis, results discussion.

Keep in mind

- Each student have his unique project. Eng. Yasmine will be manage this with you. She should upload excel file, so each one of you will write his problem title. deadline for determining the problem title is 15-May 2020.

- You can help each other by answering questions, but you are not allowed to copy from each other.

- Do not coy and past data from anywhere

- Solve the problem yourself, and write your own words that describes your solution.

- Be organize, clear, and concise.

- Upload your final report and presentation to my email (write your name, sec, BN in both the subject and the file), and the google class link provide by the TA.