Mechanics of Materials III:

Beam Bending

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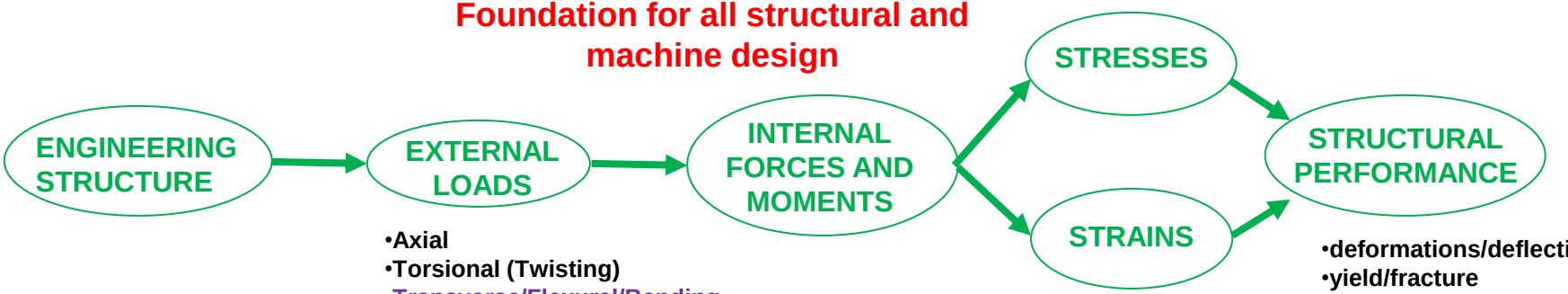
Module 2 Learning Outcomes

- Define the qualifications for a structure to be treated as beam
- Give examples of beam bending

Mechanics of Materials

Foundation for all structural and machine design



- Axial
- Torsional (Twisting)
- Transverse/Flexural/Bending
- Combined Loading

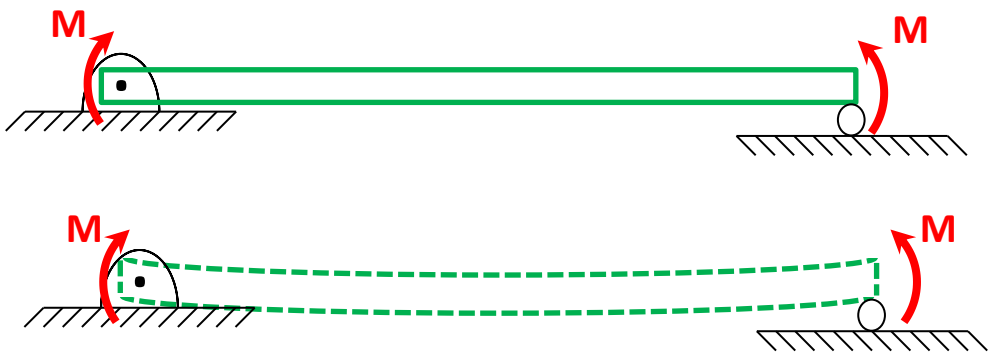
- deformations/deflections
- yield/fracture
- success/failure?

Beam Bending

Beam ≡ member loaded perpendicular to its longitudinal axis

Examples:

"Simply Supported Beam" – pins/rollers at ends



exaggerated shape when loaded

Further classified as:

"Pure bending"
Flexure under constant bending moment
No shear force

Real World Engineering Examples:

“Simply Supported Beam” – pins/rollers at ends

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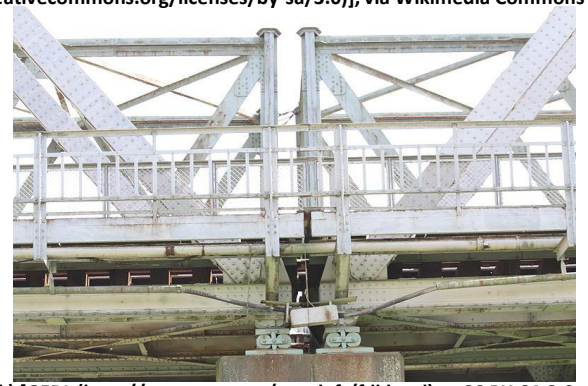

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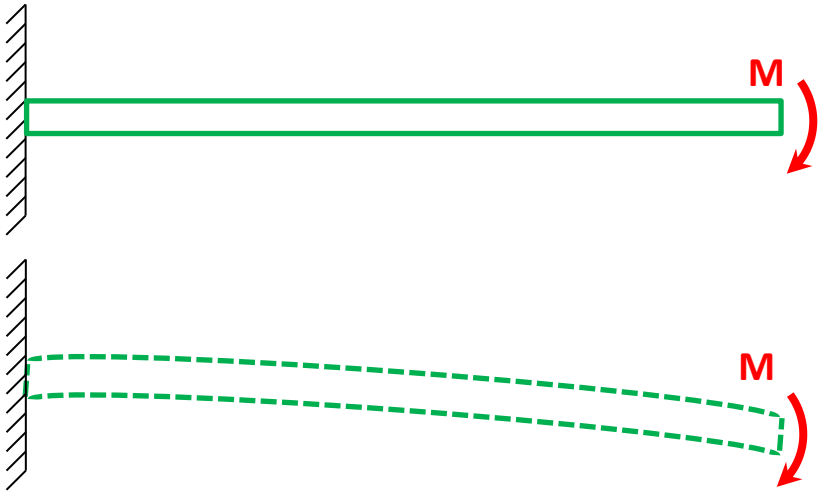
Beam Bending

Examples:

Cantilever beam



exaggerated shape when loaded

Further classified as:

"Pure bending"
No shear force

Real World Engineering Examples:

Cantilever beam

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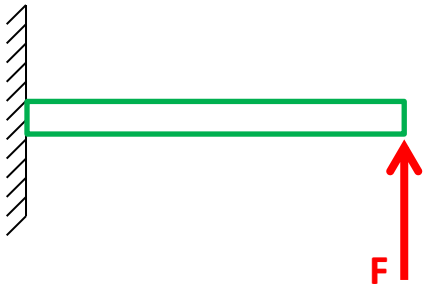


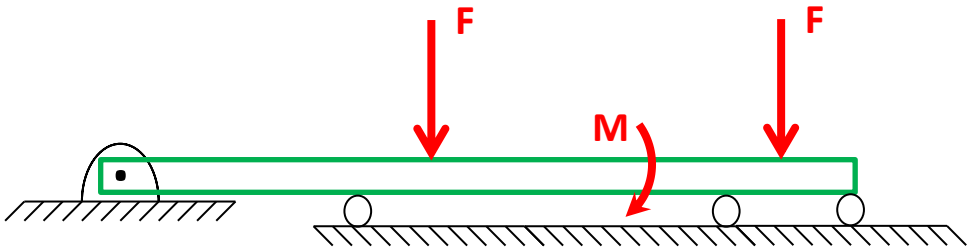
Real World Engineering Examples:

Cantilever beam

Beam Bending

Examples:

Non-uniform beam bending
Continuous beam



Beam bending/flexure
with shear force

More Real World Engineering Examples:

Bridge deck chord structure

More Real World Engineering Examples:

Machine workshop

More Real World Engineering Examples:

Wooden beams

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More Real World Engineering Examples:

Concrete beams in a barn structure

Beam Bending

We will do theory development based on pure bending. But we will use the results even when shear forces are present.

"Classical Beam Theory"
Often referred to as Euler-Bernoulli beam theory