

Structural Mechanics: Buckling

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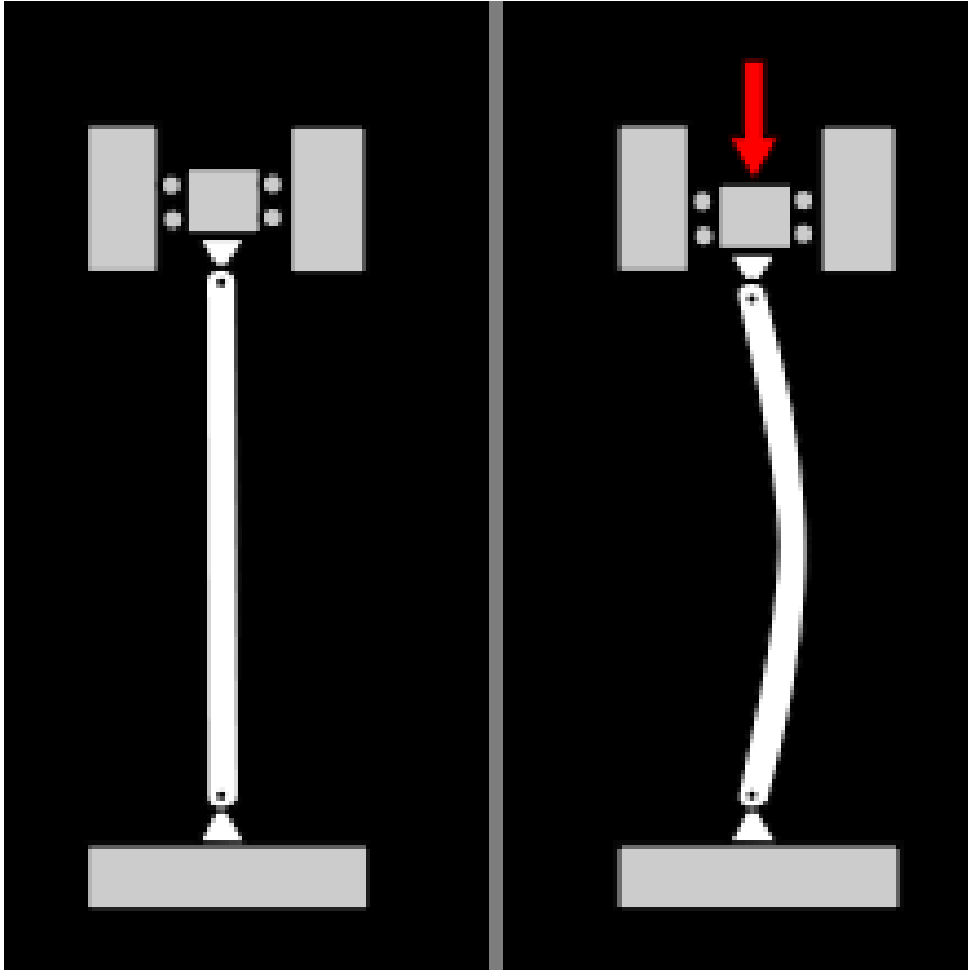
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What is buckling?

- Buckling is a “structural instability”
- Mathematically, it is a “bifurcation”.
- It occurs in structural systems that are subjected to compressive loading.
- Under those loading conditions, increasing the level of loading, at a certain stage, the structural system under consideration (despite the fact that it appears to have a smooth configuration), will fail suddenly and catastrophically.
- During buckling, the geometry of the structural system will change abruptly and substantially.
- This substantial geometry change may trigger other phenomena, such as fracture of member at critical locations.

Typical buckling failures

- Buckling of axially compressed metal columns

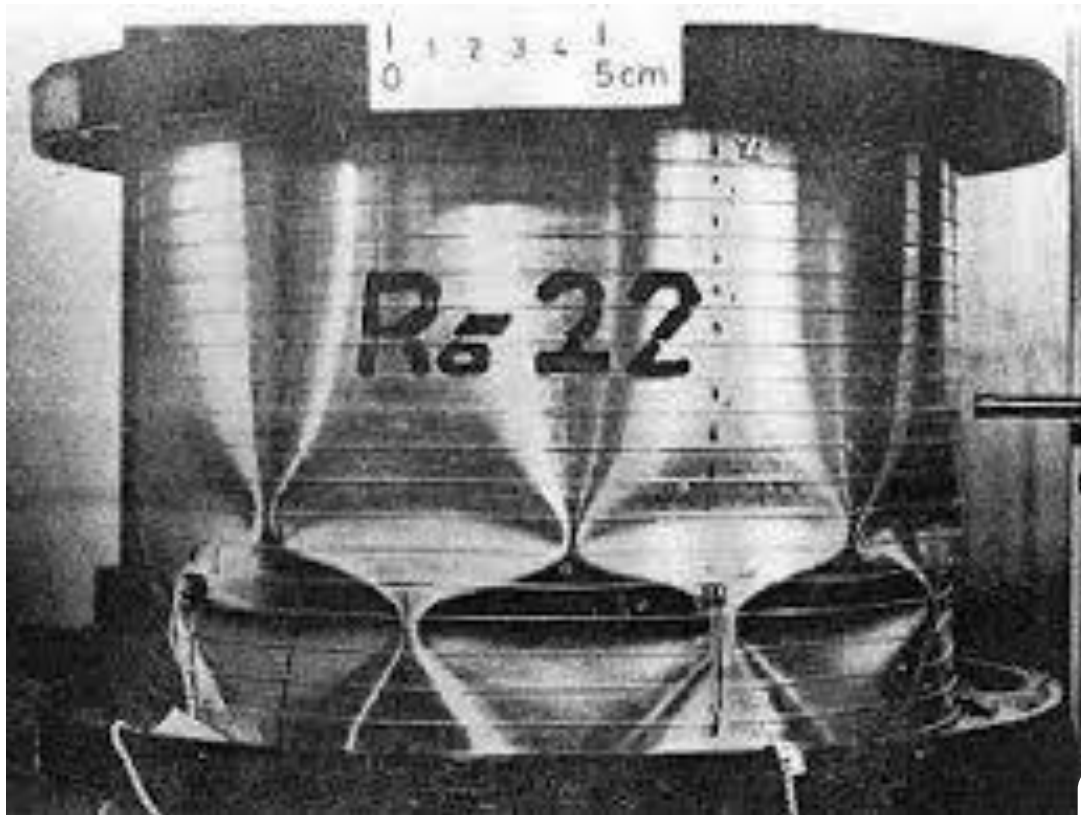


experiment

Typical buckling failures

- Buckling of axially compressed thin-walled metal shells

experiment

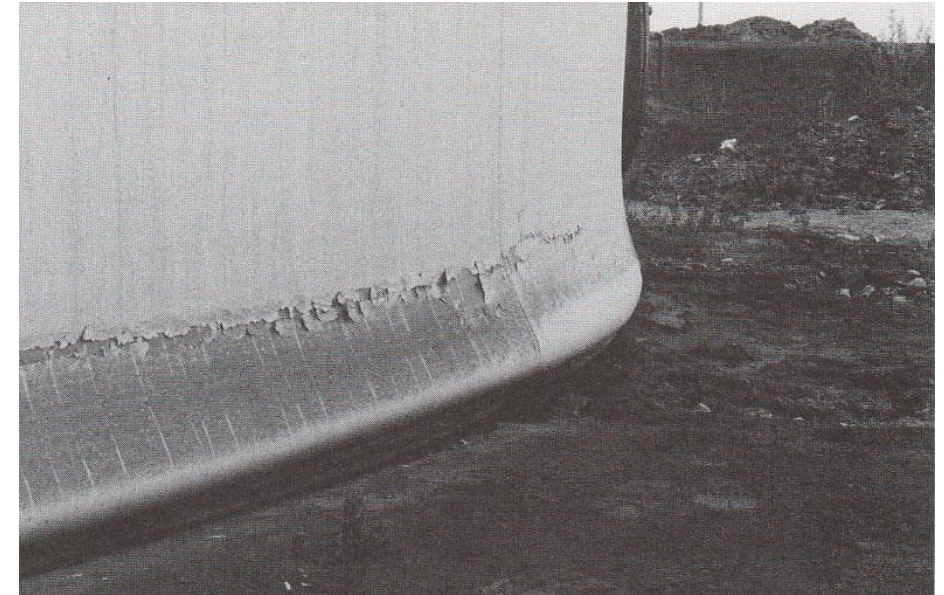
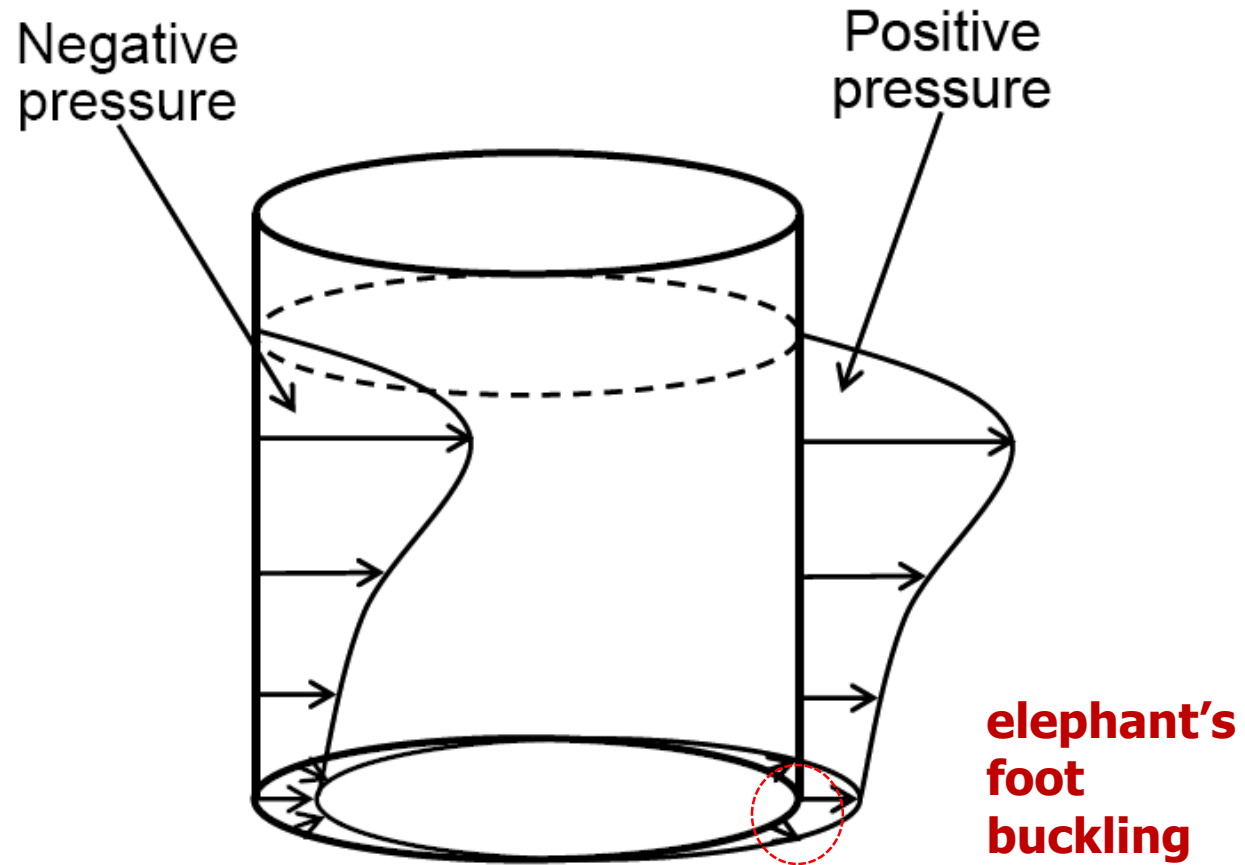


computer simulation



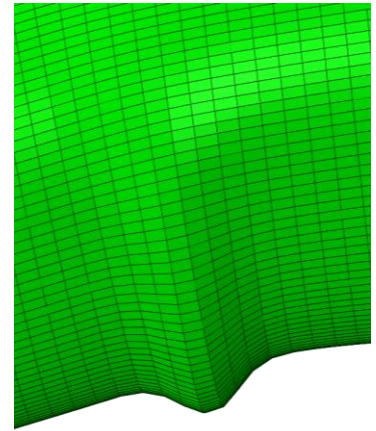
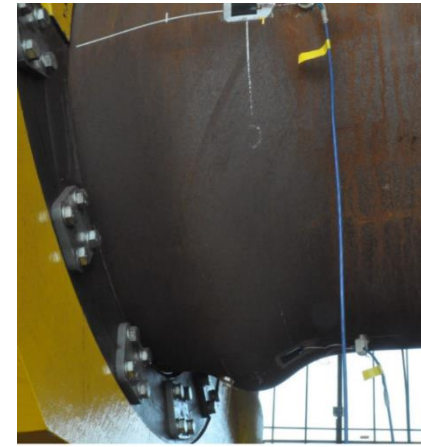
Typical buckling failures

- Buckling of steel tank because of a strong earthquake

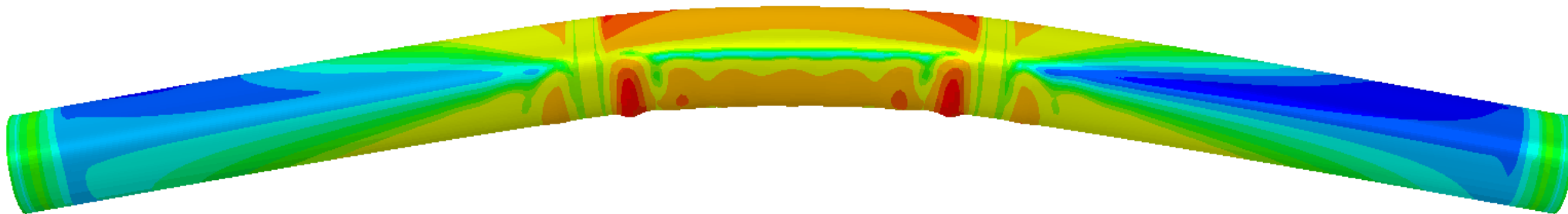


Typical buckling failures

- Buckling of steel pressurized pipe under bending



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In this course, we will:

- We will start with “bar-spring” columns, introducing the basic principles.
- Describe buckling of columns, the simplest structural system.
- Examine the parameters that may affect buckling strength of simple columns.
- Focus on the “mechanics” of buckling phenomenon.
- Provide some information on how structural engineers design columns against buckling failure.
- Extend those principles to other – more complex – structural systems, such as rings, plates and shells.