Universiti Malaysia PAHANG
Engineering • Technology • Creativity

Mechanics of Materials

Lecture 3 – Axial Load

by
Dr Nanang Fatchurrohman
Faculty of Manufacturing Engineering
fatchurrohman@ump.edu.my

Lecture 3 – Axial Load

- Aims

To analyze the deformation of axially loaded members.

To determine the support reactions when these reactions cannot be found solely from the equations of equilibrium.

To determine the effects of thermal stresses.

- Main References

Statics and Mechanics of Materials, 3rd Edition, Russell C. Hibbeler 2011, Pearson

The string of drill pipe suspended from this well spudder is subjected to significant high loadings and axial deformations.

Source: https://commons.wikimedia.org/wiki/File:Well_spudder_8606.jpg

The vertical displacements at the top of these building columns depends upon the loadings. These loading are applied on the roof and to the floor attached to their midpoint

Source: https://commons.wikimedia.org/wiki/File:Steel_Frame_Commercial_Building_Under_Construction,_Ann_Arbor_Township,_Michigan.JPG

Some concrete columns are reinforced with steel rods. These two materials work together in supporting the applied load. Hence, the forces in each material become statically indeterminate.

Source: http://maxpixel.freegreatpicture.com/Reinforcement-Site-Concrete-Blade-Steel-1891758

Hoop stress fracture failure. Hoop stress or circumferential stress is caused by a normal stress in the tangential direction.

Source:
https://en.wikipedia.org/wiki/Cylinder_stress
https://commons.wikimedia.org/wiki/File:Hoop_stress_fracture_failure.jpg

Some traffic bridges are designed with expansion joints. This will accommodate the thermal movement of the deck, thus avoid any thermal stress.

Source: http://www.geograph.ie/photo/962956

Long extensions of ducts and pipes that carry fluids are subjected to variations in climate condition. This will cause them to expand and contract. Expansion joints are used to mitigate thermal stress in the material.

Source: https://commons.wikimedia.org/wiki/File:Piping_pic1.JPG

This saw blade has grooves cut into it in order to relieve both the dynamic stress. The thermal stress develops as it heats up, Note the small circle at the end of a groove. It serves to reduce the stress concentrations that develop at the of a groove.

Source: https://www.flickr.com/photos/wackelijmrooster/4146740383