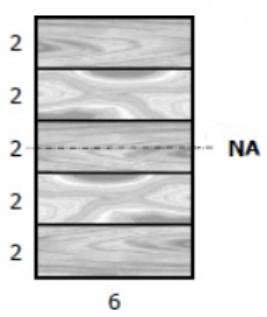
Tutorial 10

APL 104 - 2022 (Solid Mechanics)

1. A laminated beam is composed of five planks, each 6 in. by 2 in. glued together to form a section 6 in. wide by 10 in. high.



   The allowable shear stress in the glue is 90 psi, the allowable shear stress in the wood is 120 psi, and the allowable flexural stress in the wood is 1200 psi. Determine the maximum uniformly distributed load that can be carried by a simply supported beam on a 6ft simple span.

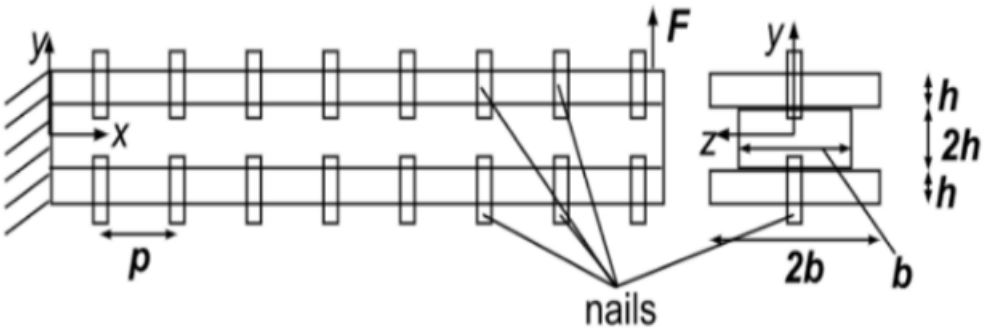
2. For an I-beam, assume the beam is subjected to tranverse load

   (a) Obtain an expression for variation in shear stress τ_{xy} within its cross-section. You can use the formula $\tau_{xy} = \dfrac{VQ\,(y)}{I_{zz}T\,(y)}$.

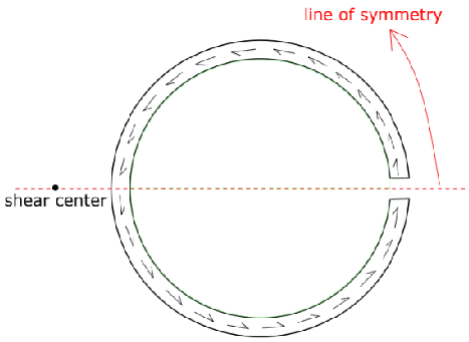
   (b) Using the expression above, draw a graph depicting qualitative variation in shear stress within the cross-section.

   (c) Where is the shear stress maximum? Find the ration of maximum shear stress to average shear stress in the cross-section.

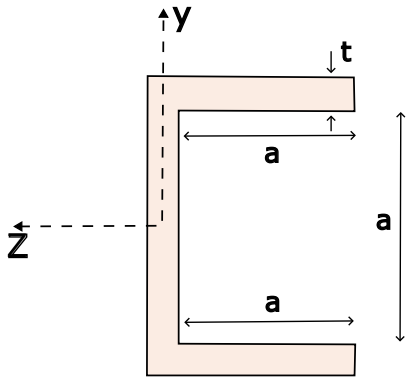
3. A cantilever beam (figure below) is made up of three wooden planks nailed together as shown. Find the expression for shear force in nails in terms of F, p, b and h. For the cross-section: $I_{zz} = 10bh^3$.



4. Think of a beam whose cross-section has the shape of a thin annular disc but having a cut (along a radial line on z-axis). How will the shear stress distribution be in the cross-section? Will such a beam undergo just bending or it can also twist?



5. Think of a beam having thin and open cross-section. The shape of the cross-section is shown in the figure. Suppose the beam is subjected to a transverse load at one of its end such that the force applied is along 'Y' axis.



   (a) Where should the load be applied in the cross-sectional plane at the tip so that the beam does not twist?

   (b) Find out shear stress distribution in the beam's cross-section assuming the beam does not twist.