Mechanics of Materials

Lecture 33 - Stress Concentration

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schedule

- 4 May - Stress Concentration
- 6 May - Buckling, Exam 3b Due
- 8 May - Review, HW 11 Due, Final Project Portion assigned

outline

- stress concentration factors

stress concentration factors

stress concentration

- Our textbook splits the idea of concentration factors across multiple chapters
- 4.7, 5.8, 6.9
- The basic idea of a stress concentration factor is that some geometry causes the maximum stress to be greater than the 'nominal' stress

stress concentration

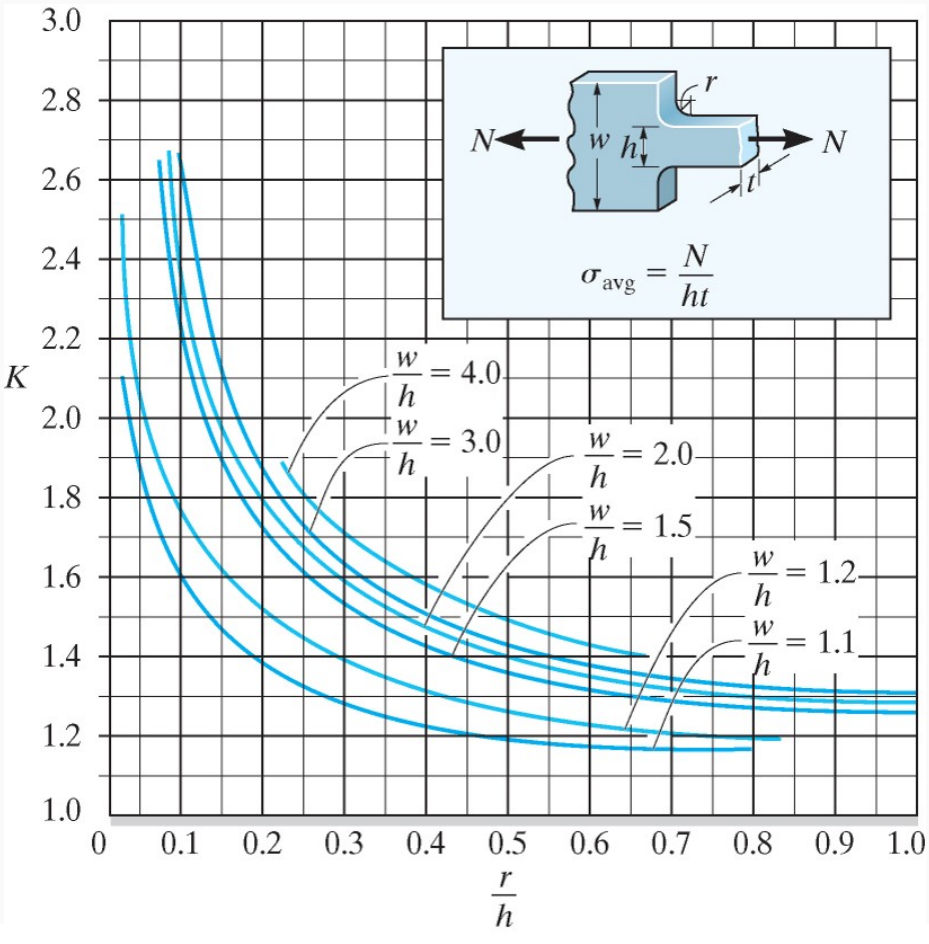
- Stress concentrations occur when there is a sudden change in cross-sectional area
- Features such as holes and fillets will have a stress concentration factor

$$K = \frac{\sigma_{max}}{\sigma_{avg}}$$

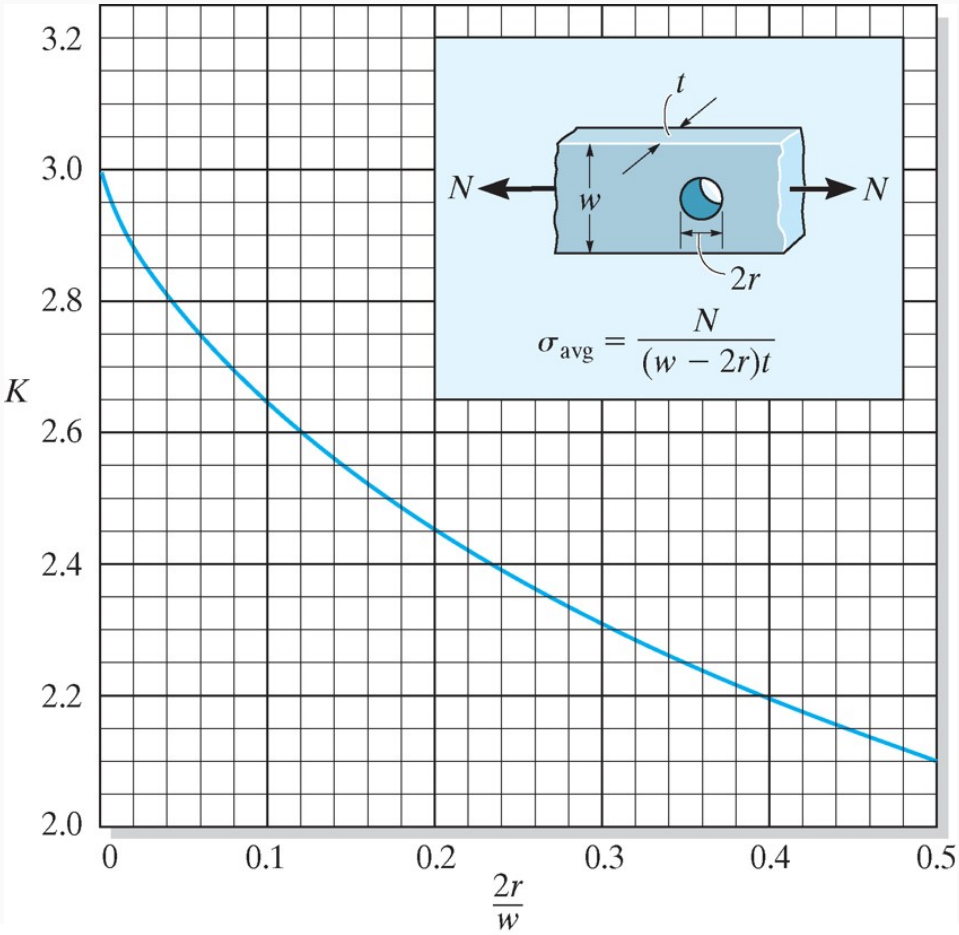
stress concentration

- The exact value of the stress concentration factor can be derived for simple shapes, but in practice it is usually looked up on a chart or figure
- The value of K depends on the ratio of the radius and depth of the feature relative to the total object depth

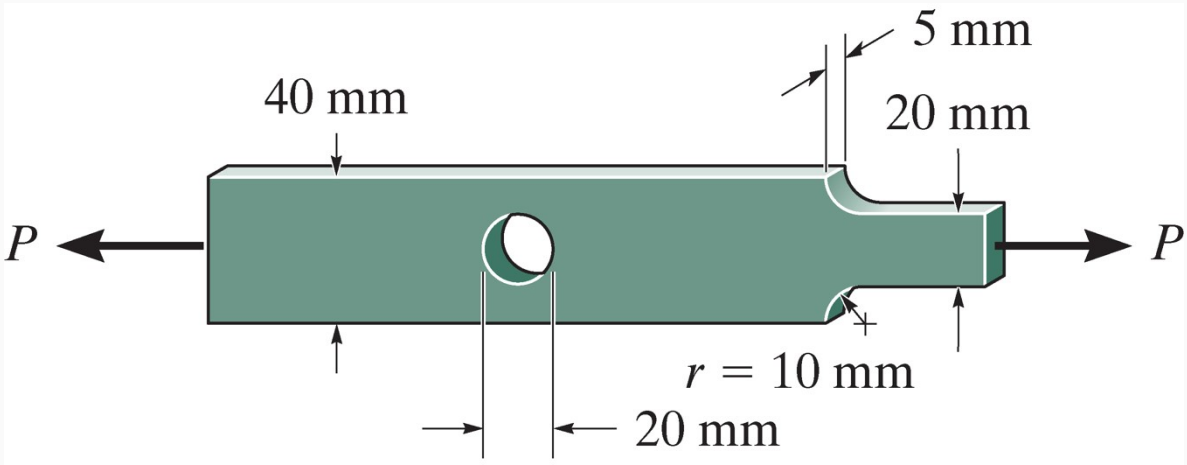
fillets



holes



example



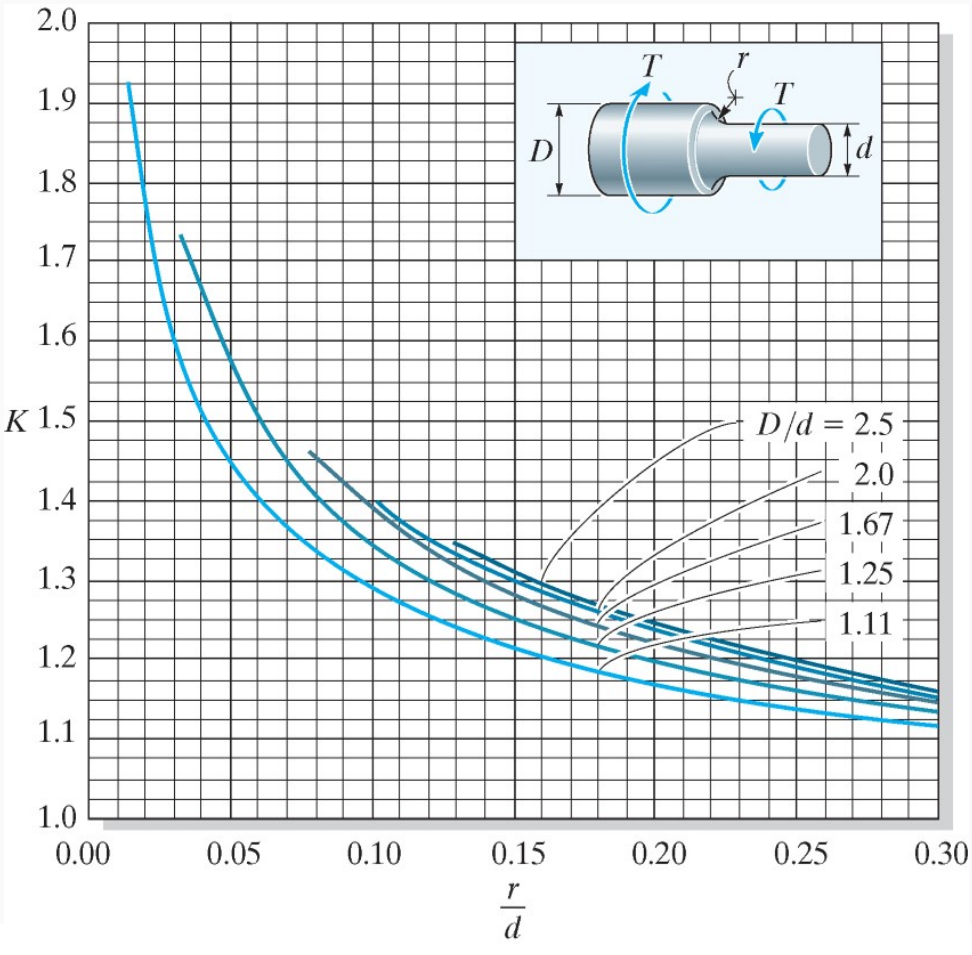
If $\sigma_{allow} = 120$ MPa, find the maximum axial force, P.

stress concentration in torsion

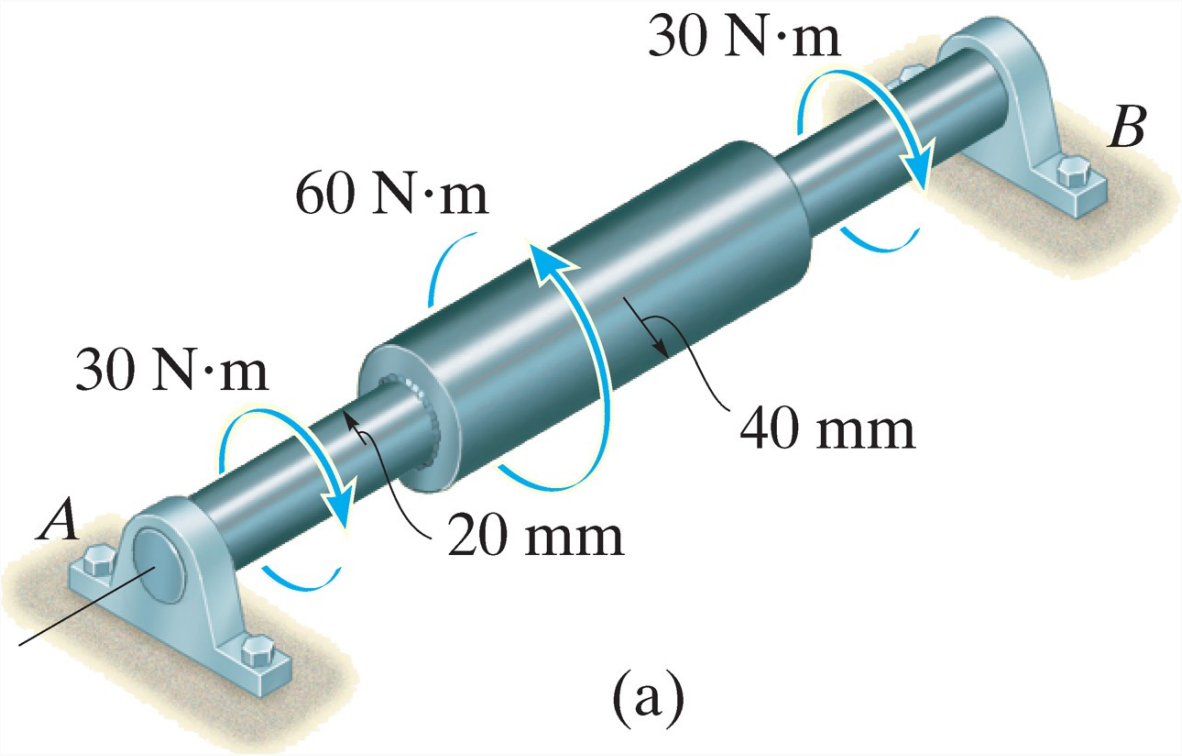
- We can also have stress concentration in torsion
- For circular shafts, this is usually around a filleted shaft as shown in the next slide
- The maximum shear can be found with

$$\tau_{max} = K\frac{Tc}{J}$$

fillet



example 5.14



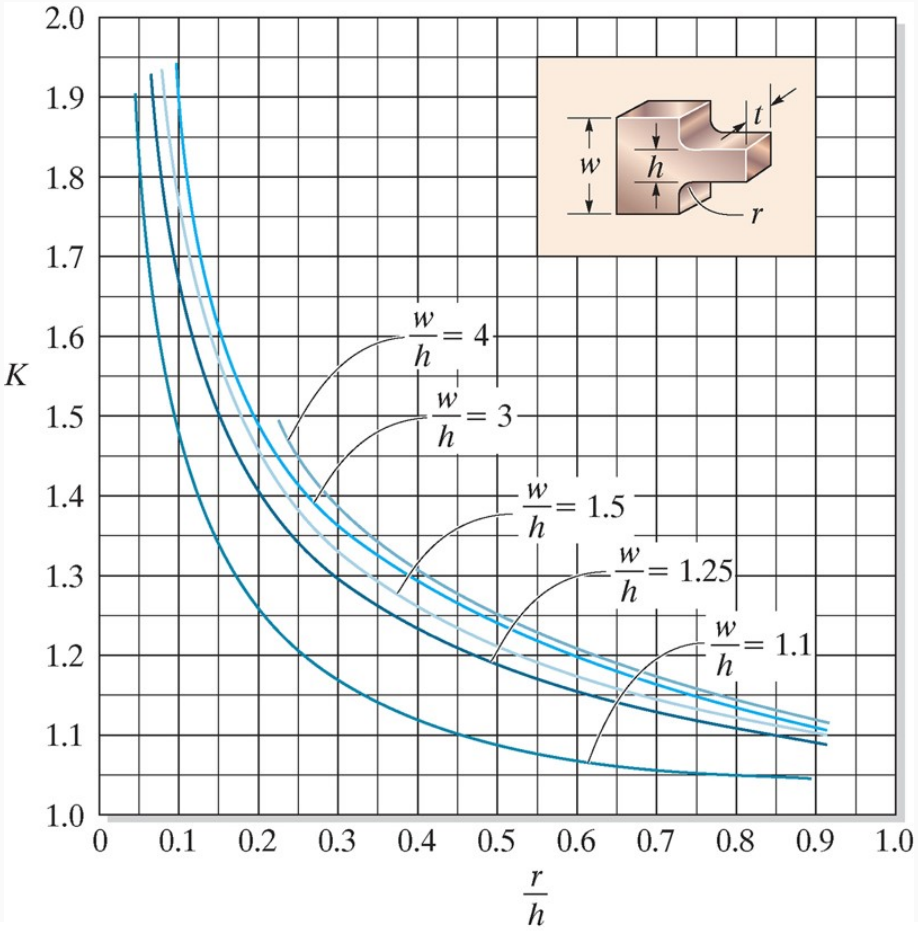
Determine the maximum stress in the shaft due to the applied torques. The shoulder fillet has a radius of r=6 mm

beams

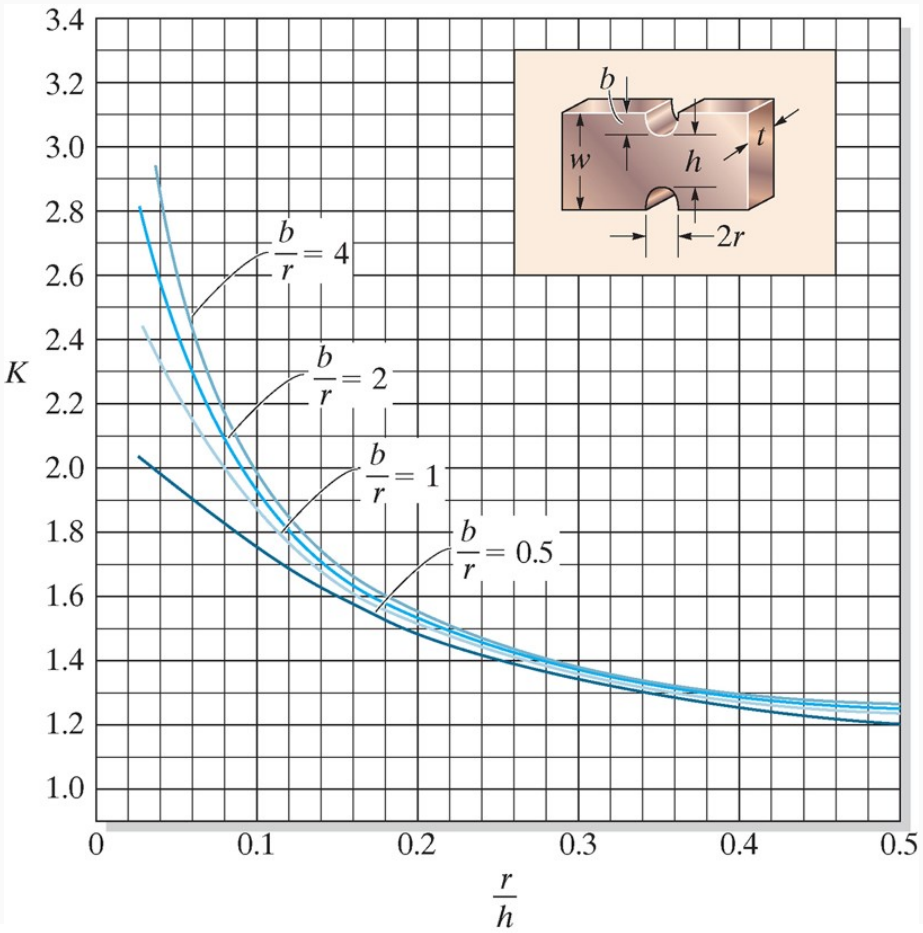
- We can also have a stress concentration in a beam
- The maximum stress can be found with

$$\sigma_{max} = K\frac{Mc}{I}$$

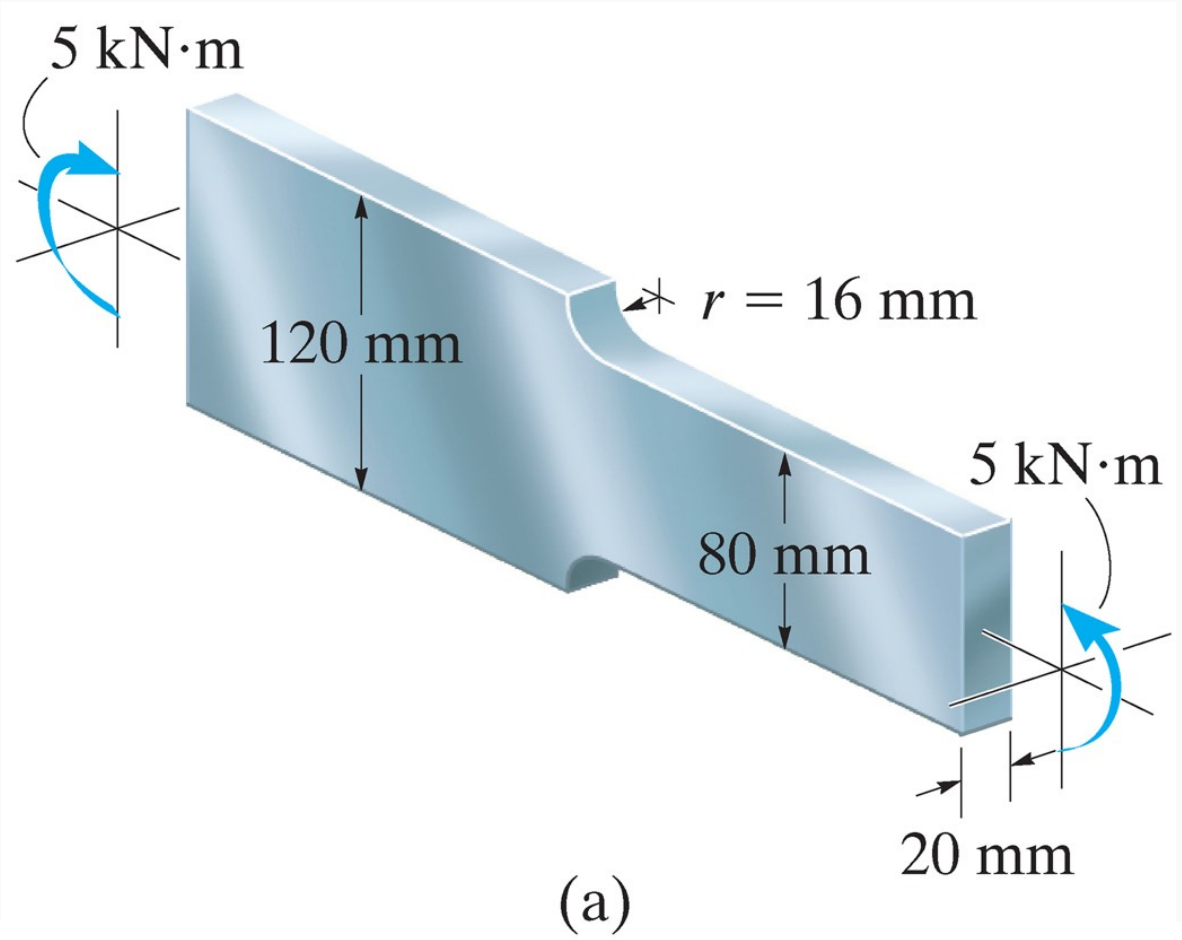
fillet



notch



example 6.20



Determine the maximum normal stress for a steel bar with a shoulder fillet as shown.