OBJECTIVES:  
1. Stress Concentration in Beams with Notches  
2. Describes in Elastic Bending  
3. Example

Read:  
PHILPOT B.9

Previously Assumed Prismatic:

- What is stress in cross section?  
  \[ \sigma = \frac{My}{I} \]  
  (Flexure Formula)

- But, say we have change in member

  "Notched"  
  "Fillet"

- We want to know max stress in vicinity of abrupt change:

  Use stress concentration factor, \( K \)

  \[ \sigma_{max} = K \frac{MC}{I} \]

  Look up on chart

- For example

  Say  
  \[ \frac{a}{h} = 0.2 \]
  \[ \frac{w}{h} = 1.5 \]

  234 MPa (based on regular flexure formula)

  \[ \sigma_{max} = K (234 \text{ MPa}) \]

  \[ = 340 \text{ MPa} \]

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Inelastic Bending:

First, what is maximum elastic moment?

\[
M_y = \int y (\sigma \text{d}A) = \int_{-h/2}^{h/2} y \left( \frac{2\sigma_{\text{max}}}{h} \right) y \, b \, dy
\]

\[
= \frac{2b}{h} \sigma_{\text{max}} \int_{-h/2}^{h/2} y^2 \, dy
\]

\[
= \frac{2b}{h} \sigma_{\text{max}} \left[ \frac{y^3}{3} \right]_{-h/2}^{h/2}
\]

\[
= \frac{2b}{h} \sigma_{\text{max}} \left( \frac{h^3}{24} + \frac{h^3}{24} \right)
\]

\[
M_y = \frac{bh^2}{6} \sigma_y
\]
Load past $\varepsilon_y$:

\[ M = \frac{3}{2} M_y \left( 1 - \frac{4}{3} \frac{y^2}{h^2} \right) \]

Is there a limit? Yes!

\[ M_p = \frac{\sigma_y bh}{2} \cdot \frac{1}{2} = \frac{1}{4} bh^2 \sigma_y = M_y \]

\[ M_p = \frac{3}{2} M_y \]

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Since can not take any more load, called, "Pinning".

behaves like a "PIN" or "HINGE"