Lecture 27: Fatigue Failure Theories IV

BAEN 375

Design Fundamentals of Agricultural Machines and Structures

Notches and Stress Concentrations

- Notch
  - Generic term
  - Geometric contour
  - Disrupts “force flow”
- Examples
  - Hole
  - Groove
  - Fillet
  - Abrupt change in cross section
  - Disruption to smooth contours of a part

Notches and Stress Concentrations

- Remember
  - Notches should have largest radius possible
  - Ductile materials
    - Under static load yield at local stress concentrations, reducing stress in that area to acceptable levels
    - Under dynamic load behave as if they are brittle
  - We defined stress-concentration factors for static loads
    - K_t for normal stress
    - K_{ts} for shear stress

Notches and Stress Concentrations

- For dynamic loads
  - We must modify K_t and K_{ts}
  - Based on the material's "notch sensitivity"
  - To obtain K_f, fatigue stress-concentration factor

$$K_f = 1 + q(K_t - 1)$$

  - Where K_t represents either K_t or K_{ts}
    q represents notch sensitivity

Notches and Stress Concentrations

$$q = \frac{1}{1 + \frac{\sqrt{a}}{\sqrt{r}}}$$

- Where r = notch radius

  a = Neuber constant, which varies with S_{ut}

- Note that Table 6-6 lists values of the square root of the Neuber constant, $\sqrt{a}$