Lukhdhirji Engineering College, Morbi

Department of Mechanical Engineering

Assignment 10- Design Against Fluctuating Loads:(CO4)

Subject: Fundamental of Machine Design (3141907) Semester: 4th

Year : 2022-23

1. Explain the different factors affecting the fatigue behavior.
2. What is cumulative damage in fatigue? Explain in brief.
3. Define Stress concentration? State the methods of reducing stress concentration.
4. What is endurance strength? Discuss the factors affecting endurance strength of materials?
5. Derive Soderberg's equation and state its application to different types of loadings.
6. Explain Goodman's line and Gerber Line with neat sketch.
7. A cantilever beam made of cold drawn steel 4OC8 ($Sut = 600$ N/mm^2 and $Syt = 380$ N/mm^2) is shown in Fig. The force P acting at the free end varies from –50 N to +150 N. The expected reliability is 90% and the factor of safety is 2. The notch sensitivity factor at the fillet is 0.9. Determine the diameter 'd' of the beam at the fillet cross-section.
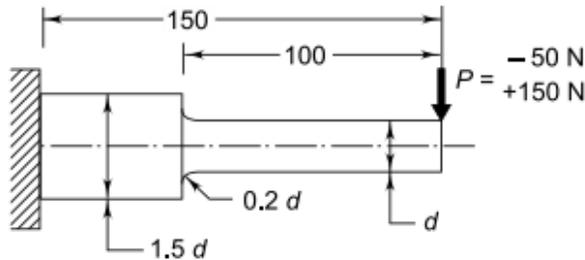
8. A plate made of steel 20C8 ($Sut = 440$ N/mm2) in hot rolled and normalized condition is shown in Fig. 5.28. It is subjected to a completely reversed axial load of 30 kN. The notch sensitivity factor q can be taken as 0.8 and the expected reliability is 90%. The size factor is 0.85. The factor of safety is 2. Determine the plate thickness for infinite life.
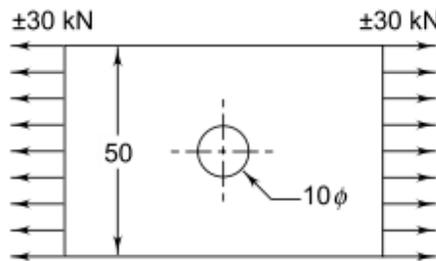
9. A forged steel bar, 50 mm in diameter, is subjected to a reversed bending stress of 250 N/mm^2. The bar is made of steel 40C8 ($S= 600$ N/mm^2). Calculate the life of the bar for a reliability of 90%.
10. A machine component is subjected to two-dimensional stresses. The tensile stress in the X direction varies from 40 to 100 N/mm while the tensile stress in the Y direction varies from 10 to 80 N/mm^2. The frequency of variation of these stresses is equal. The corrected endurance limit of the component is 270

N/mm^2. The ultimate tensile strength of the material of the component is 660 N/mm^2. Determine the factor of safety used by the designer.

11. A steel cantilever is 200 mm long. It is subjected to an axial load which varies from 150 N (compression) to 450 N (tension) and also a transverse load at its free end which varies from 80 N up to 120 N down. The cantilever is of circular cross-section. It is of diameter 2d for the first 50 mm and of diameter d for the remaining length. Determine its diameter taking a factor of safety of 2. Assume the following values :

Yield stress	= 330 MPa
Endurance limit in reversed loading	= 300 MPa
Correction factors	= 0.7 in reversed axial loading
	= 1.0 in reversed bending
Stress concentration factor	= 1.44 for bending
	= 1.64 for axial loading
Size effect factor	= 0.85
Surface effect factor	= 0.90
Notch sensitivity index	= 0.90