FAT1 EXERCISE: S-N CURVES – SOLUTION

Exercise 1:

1.1 A detail category corresponds to 2 million cycles.

1.2 The stress difference $\Delta\sigma_D$ is expressed from the equation of the curve (C is the constant of position of the curve):

$$N = C\Delta\sigma^{-m}$$

$$C = N\Delta\sigma^{m}$$

$$2 \cdot 10^6 \cdot \Delta\sigma_C^3 = 5 \cdot 10^6 \cdot \Delta\sigma_D^3$$

$$\Delta\sigma_D = (2/5)^{1/3} \cdot \Delta\sigma_C = 0{,}737 \cdot \Delta\sigma_C$$

1.3 The detail category is: $\Delta\sigma_C = (C/N)^{1/m} = (1{,}46 \cdot 10^{12}/2 \cdot 10^6)^{1/3} = 90$

The stress difference corresponding to 100'000 cycles: $\Delta\sigma = (C/N)^{1/m} = (1{,}46 \cdot 10^{12}/100000)^{1/3} = 244{,}3\ MPa$

1.4 The calculation value of the stress difference is = 40 - (-30) = 70 MPa. The average stress has no influence on the service life.

Since $\cdot\ \Delta\sigma$ = 70 MPa < $0{,}737 \cdot \Delta\sigma_C = 73{,}7\ MPa$, the **lifespan is infinite**

Exercise 2:

2.1 B, the solution of the problem of crack instability is analogous to that of buckling.

2.2 Highest to lowest initiation portion:
A) Mechanical parts
B) Drilled Holes
C) High-quality welded joints
D) Standard welded joints

2.3 Common parameters are A) imperfections, B) scale effects, C) residual stresses.

Exercise 3: Failure cases, to be submitted by group