

Errata ECCS manual fatigue design of steel and composite structures

3.3.4 "stress in welds", pages 99-100

The book says "sigma parallel" should be considered and combined to find "sigma w", this is wrong and thus the formula 3.23 contains an error.

The formulas in EN 1993-1-9, section 5 (6), page 12 are correct, see below.

(6) The relevant stresses in the welds are (see Figure 5.1)

- normal stresses σ_{wf} transverse to the axis of the weld: $\sigma_{wf} = \sqrt{\sigma_{\perp f}^2 + \tau_{\perp f}^2}$
- shear stresses τ_{wf} longitudinal to the axis of the weld: $\tau_{wf} = \tau_{\parallel f}$

for which two separate checks should be performed.

NOTE The above procedure differs from the procedure given for the verification of fillet welds for the ultimate limit state, given in EN 1993-1-8.

One has to combine the sigma and tau perpendicular, which acts on the same facet to get the normal stress transverse to the axis of the weld.

Then one has two other stresses, longitudinal, that can act on the weld:

- the shear stress longitudinal to the axis of the weld, equation (3.24)
- the normal stress on the whole section longitudinal to the axis of the weld, and thus acting also on the weld, σ_{\parallel}

Correct formulas :

- Nominal resulting normal stress :

$$\sigma_w = \sqrt{\sigma_{\perp}^2 + \tau_{\perp}^2} \quad \text{with} \quad \tau_{\perp} = \frac{F_x}{w \cdot \ell} \tag{3.23}$$

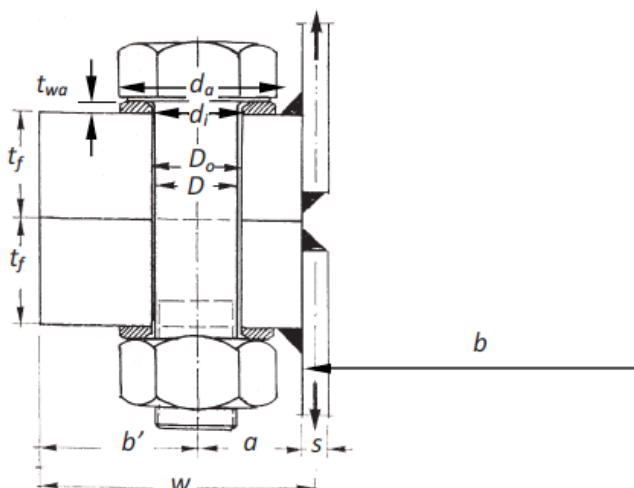
- Nominal resulting shear stress :

$$\tau_w = \tau_{\parallel} = \frac{F_y}{w \cdot \ell} \tag{3.24}$$

Suppress equation (3.25)

Figure 3.34, page 132

Some legends are not placed appropriately, see corrected version below.



Example 5.7, pages 216- 217

The table with damage sum is wrong.

For the lorries causing damage, lorry no 3, ni for 100 years is 100 millions and Ni should be 69424000 cycles. And for lorry no 5, ni is 20 millions and Ni = 88396000 cycles. Then we get $D_i = 1.44 + 0.226 = 1.667$. It will effectively not meet the 100 years life, but only $100 * 1 / 1.667 = 60$ years.

Thus, this example shows that FLM 4 is more detrimental than FLM3, and that effectively they are not well matched/calibrated. Especially since the engineer is not rewarded for making the effort of using a longer verification procedure with FLM4 instead of FLM3.

Corrected table 5.4

| FLM4 Lorry | Traffic share (%) | ni/year | Sr (MPa) | ni | Ni | Di=ni/Ni |
|--------------|-------------------|----------------|----------|------------------|-------------|--------------|
| 1 | 20 | 400000 | 9.7 | 40000000 | infini | 0.000 |
| 2 | 5 | 100000 | 12.5 | 10000000 | infini | 0.000 |
| 3 | 50 | 1000000 | 21.2 | 100000000 | 69423784.58 | 1.440 |
| 4 | 15 | 300000 | 18.6 | 30000000 | infini | 0.000 |
| 5 | 10 | 200000 | 20.2 | 20000000 | 88395619.25 | 0.226 |
| Total | 100 | 2000000 | | 200000000 | | 1.667 |

Working
life=

60.0 years