Static FKM limits for notch stresses for structural steel S 235
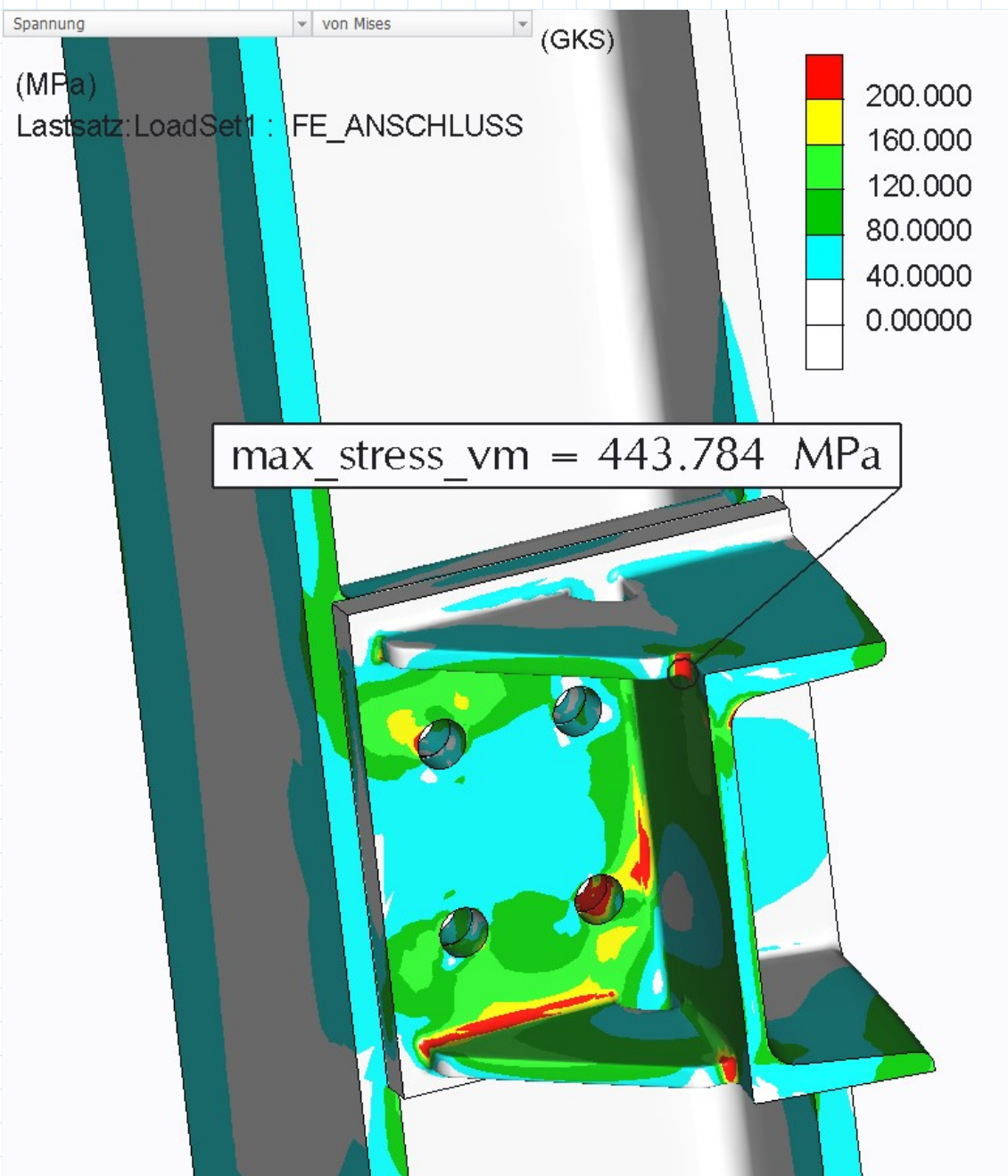

Figure 1: Example of a connection in steel construction (structural steel S 235)

Is the maximum static equivalent stress of approx. 444 MPa (Fig. 1) too high?

The following references are to the FKM Guideline:
Computational Strength Analysis, FKM Guideline, 7th edition 2020.

$E := 210000 \ MPa$ — Young's modulus, Table 3.3.3, steel

$R_p := 240 \ MPa$ — yield strength, Table 5.1.24, S 235

$R_m := 360 \ MPa$ — tensile strength, Table 5.1.24, S 235

$\varepsilon_{ertr} := 0.05 = 5\%$ — tolerable elongation, Table 3.3.3, steel

$j_p := 1.5$ — maximum basic safety factor against yield strength, high consequence of damage, high probability of occurrence of stress, Table 3.5.1

$\alpha_w := 0.95$ — weld factor, Table 3.3.5, S 235

$n_{pl} := \sqrt{\dfrac{E \cdot \varepsilon_{ertr}}{R_p}}$ — plastic index, (3.3.21), steel

$\sigma_{SK} := R_p \cdot \dfrac{n_{pl}}{j_p} = 1058 \ MPa$ — maximum permissible linear * notch stress (FEM), static, not welded, vgl. (3.4.2)

$\sigma_{SK\_w} := \alpha_w \cdot R_p \cdot \dfrac{n_{pl}}{j_p} = 1005 \ MPa$ — Maximum permissible linear * local structural stress (FEM), static, at weld transition, vgl. (3.4.4)

(*) Hooke's law applies to the linearly calculated FEM results, as specified in the FKM. In reality, the local stress peaks are plastically reduced.