UNIVERSITÀ DEGLI STUDI DI BERGAMO
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Numerical simulation of Rotary Shouldered Threaded Connections under Combined Static Loading

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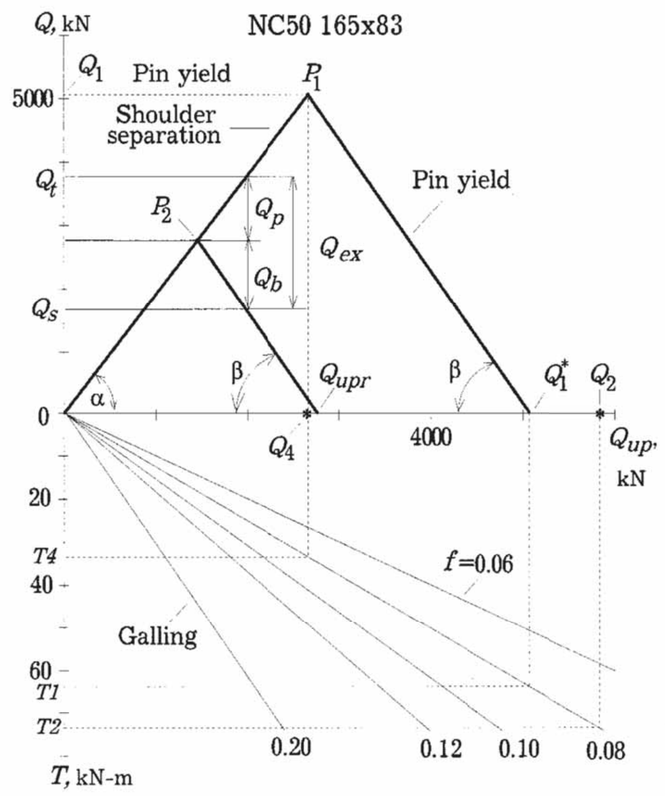
Abstract

Rotary Shouldered Connections (RSC) are vital components of the extraction equipment in the oil and gas industry. Although the standards propose practical rules for drawing working limits for these mechanical parts, the combination of make-up torque and tensile and compressive external loads often produces damage and breakages during drilling operations. In order to model the complex non-linear effects, a FEM model of the threaded pin-box shouldered connections is developed, describing friction contact and including plastic effects by a linear elastic – perfectly plastic model. Due to the complexity of the geometry, 2D axialsymmetric eight –node biquadratic elements are adopted. The effects of traction on the pin and compression on the box generated by the make-up torque are simulated introducing a suitable heat load, by considering a virtual orthotropic coefficient of thermal expansion. Results are validated against experimental data [1,2].



[1]

Q [kN] axial load

T [kN m] torsional load

Q_{up} [kN] makeup load

Q_{upr} [kN] recomended makeup load

Q_{ex} [kN] external applied axial load

M_{up} makeup torsional moment

Q_p [kN] pin cyclic load due to **Q_{ex}**

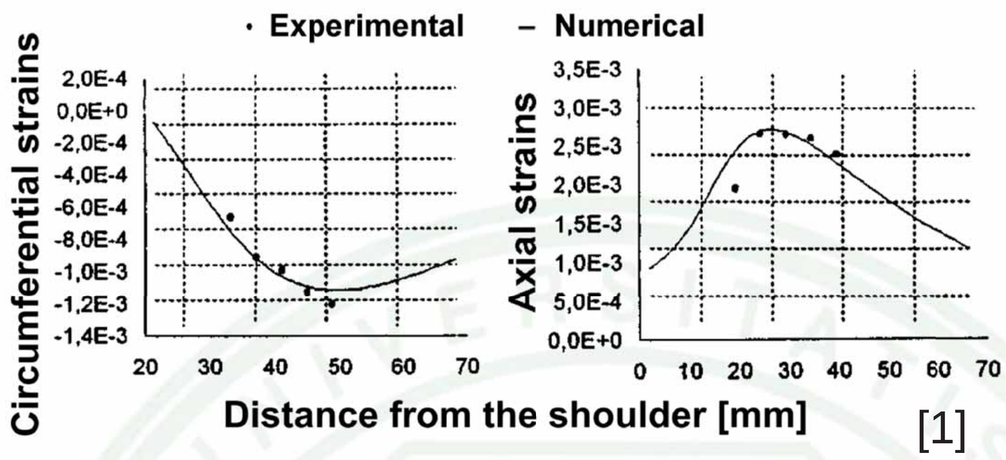
Q_b [kN] box cyclic load due to **Q_{ex}**

Q_t [kN] Axial thread load due to **Q_{ex}**

Q_s [kN] Axial shoulder load due to **Q_{ex}**

Q_1 [kN] pin yeld (external load)

Q_1* [kN] pin yeld (makeup load)



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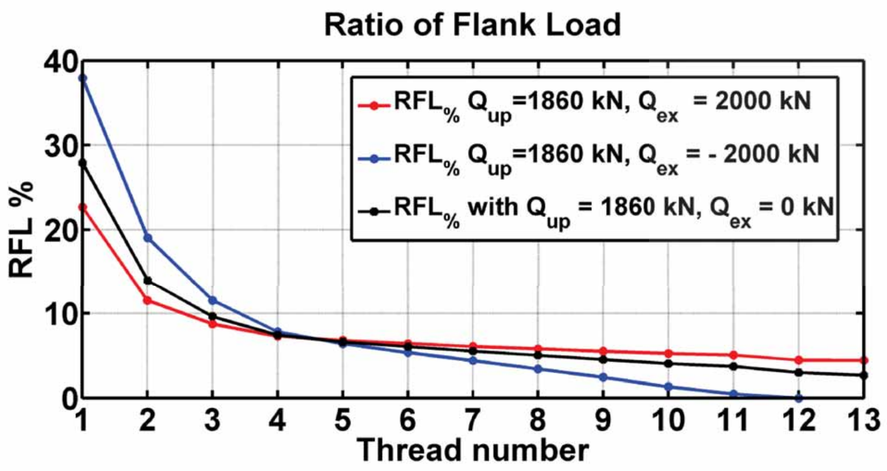
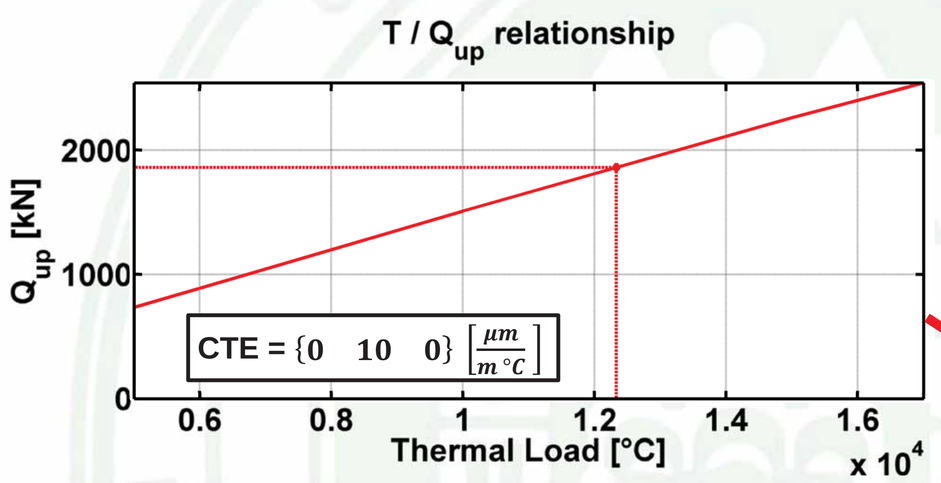
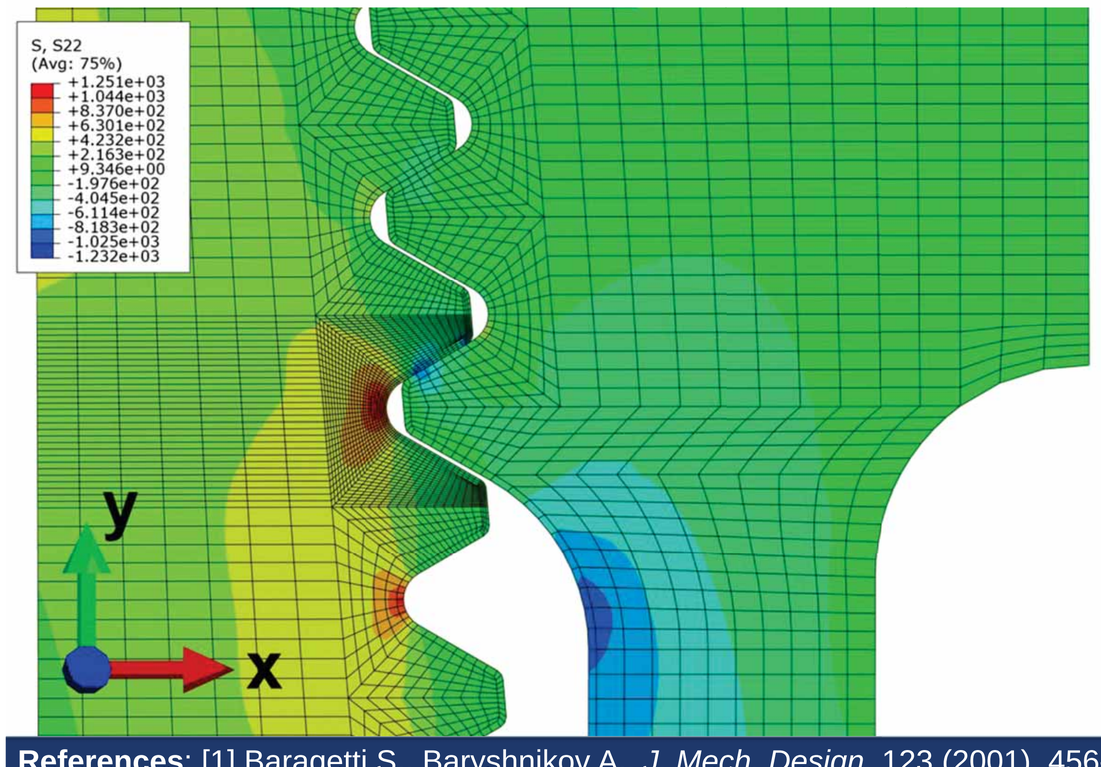
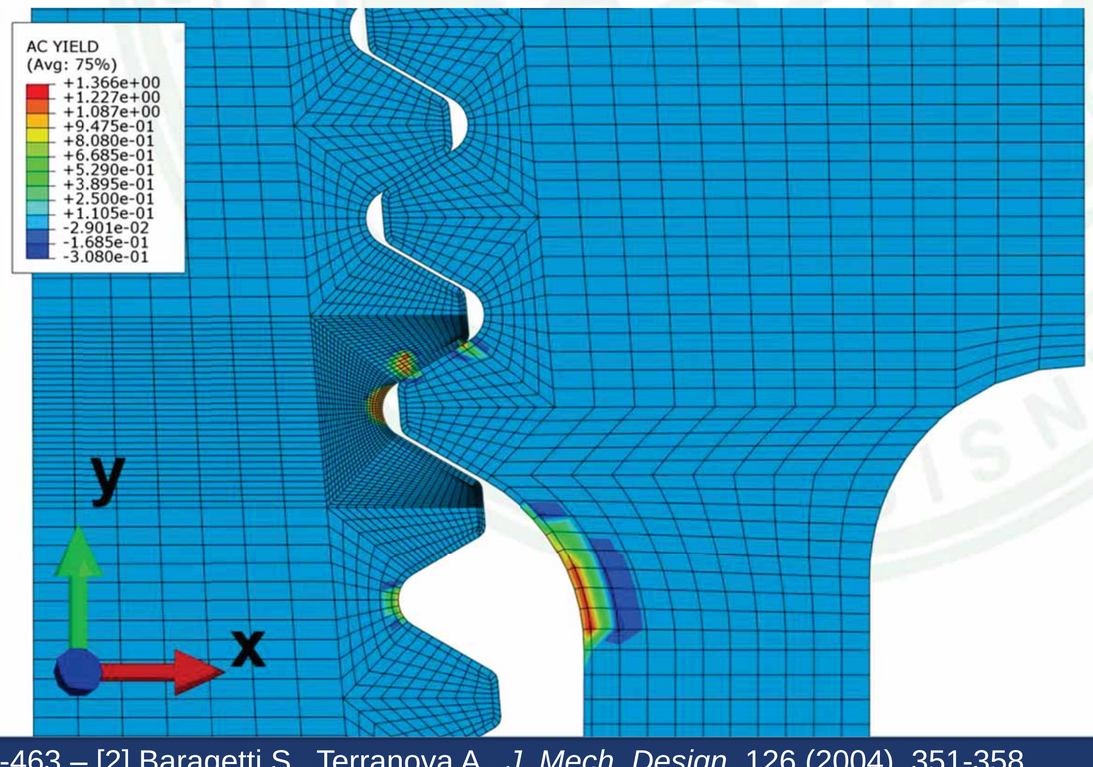




σ_{yy} [MPa] (left) and plastic flow (right) for M_{up} = 24 kNm, Q_{up} = 1860 kN, Q_{ex} = 0 kN, *f = 0.08*





References: [1] Baragetti S., Baryshnikov A., *J. Mech. Design,* 123 (2001), 456-463 – [2] Baragetti S., Terranova A., *J. Mech. Design,* 126 (2004), 351-358