T73S06 Session 27 Homework – Secondary Stress Effects on Rupture
Revised 26/11/14

Mentor Guide Questions

Provide written answers to K&S questions 4.6 and 5.1 to 5.4.

Numerical Questions

A plant component of 316H is welded using a similar 316H consumable. It is a creep ductile material. It operates at a steady 540^{o}C at which temperature its 0.2% proof strength is 200 MPa (the same for parent and weld, and this can be taken to be S_y). The primary reference stress under operating conditions has been evaluated to be 120 MPa, whilst the peak elastic Mises stress on the section of interest is 240 MPa. It is also subject to thermal transients during start-up and shut-down, which produce a predominantly bending stress distribution with an associated linearised elastic stress range of 200 MPa.

[1] Use R66 rupture data to evaluate the lower bound primary load creep rupture lifetime for both parent and weld material using the procedure of R5V2/3 Section 6.5.

[2] Use R66 rupture data to evaluate the lower bound creep lifetime accounting for cyclically enhanced creep effects, for both parent and weld material, using the procedure of R5V2/3 Section 7.5.

Noting that the Soviet rupture model in R66 Rev.009 is no longer the recommended mode, in [1] and [2] you may alternatively use the revised model of S L Spindler, K Jackson and M W Spindler, “A Creep Rupture Analysis of Type 316H Stainless Steel”, E/REP/BBGB/0075/AGR/11.