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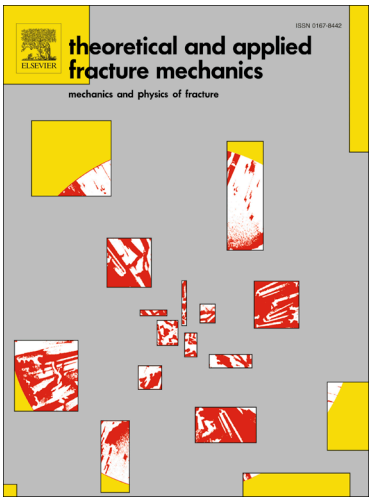

Two-parameter approach of creep crack initiation times considering the constraint effect induced by specimen geometry

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Two-parameter approach of creep crack initiation times considering the constraint effect induced by specimen geometry

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Abstract: In this paper, a two-parameter approach and finite element method were conducted to investigate the constraint effect of six different types of cracked specimen geometries on the creep crack initiation (CCI) time. The theoretical enhanced model of the *C**–*Q** approach, which considers the load-independent constraint parameter *Q**, was proposed to predict the CCI time around a sharp crack tip. The order of *Q** values and the creep damage accumulation rate for the different specimen geometries was C(T) > CS(T), SEN(B) > SEN(T) > DEN(T) > M(T). Whereas the CCI times were ordered conversely. The influence of the constraint on hydrostatic stresses, triaxiality and multiaxial strain factor was discussed. The suitability of the two-parameter approach was verified due to the comparison of CCI times between theoretical and simulated results, which demonstrated that the *C**–*Q** two-parameter prediction approach under stress intensity factor—Riedel–Rice (K-RR) control (initially by K, then by transient creep stress or Riedel–Rice conditions) and Hutchinson–Rice–Rosengren—Riedel–Rice (HRR-RR) control (initially by plastic HRR control, then by RR conditions) could conservatively and effectively predict the CCI times. The K-RR solutions were more accurate when initial stress intensity factor K < 6 MPam$^{1/2}$, while the HRR-RR solutions were more appropriate when K > 6 MPam$^{1/2}$.

Keywords: Creep Crack initiation; Load-independent Constraint Parameter *Q**; Two-parameter approach; Hydrostatic stresses; Triaxiality; Specimen geometries;

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