Abstract Transactions, SMiRT-24
BEXCO/Centum Hotel, Busan, Korea - August 20-25, 2017

IASMiRT

A Rule for Assessment of Interacting Coplanar Cracks Based on Creep Crack Growth Life

Jian-Feng Wen[1,2], Yong Zhan[3], Shan-Tung Tu[4,*], Fu-Zhen Xuan[4]

[1] Lecturer, East China University of Science and Technology, China
[2] Postdoctoral Research Associate, Texas A&M University, USA
[3] CAE Engineer, Consys Consulting System, China
[4] Professor, East China University of Science and Technology, China
[*] Corresponding author

Abstract

Multiple flaws are commonly detected in structures operating under high temperature conditions. A proper prediction of the interaction effect of them is indispensable to preventing the potential catastrophic failure. In the present study, creep crack growth simulations, for a plate containing two coplanar surface flaws with both identical and dissimilar sizes, are undertaken in detail by a step-by-step finite element analysis. Combination rules for multiple coplanar flaws provided by fitness-for-service codes (ASME, BS7910, API579 and GB/T19624) are critically assessed for the creep failure mode. It is realized that the conservatism contained in existing criteria is highly dependent on the ratio of crack depth to the thickness. With the increase of crack size, as well as the similarity between two cracks, some criteria may lead to a higher risk of non-conservative estimation. Parametric analyses of material properties are also conducted. On the basis of creep crack growth life, a combination rule considering the effect of crack depth is developed and examined. Remarkably, it performs well with necessary conservatism for all cases investigated here.

Keywords

Crack combination rule; Creep crack growth; Finite element analysis; Flaw characterization