

Fracture Toughness Evaluation for Magnetostrictive Problem Using COMSOL Multiphysics®

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Abstract

Even though failure due to the presence of flaws, inclusions, cracks or crack like defects has been observed in structural components operated under magnetic fields. The creation of the ferrous man-made structures, however, the formulations of various fracture theories and the understanding of this phenomenon rapidly accelerated during the 20th century. It should be understood clearly that catastrophic consequences of structural failure are sometimes hard to avoid because the factors involved in predicting fracture are very complex. In this manuscript, the influence of magnetostriction on the fracture behavior of Ferri or ferromagnetic materials has been studied with the help of energy release rate of cracked specimens subjected to the electro-magnetic environment. The derived contour integral has been used to compute the path independent integral using COMSOL Multiphysics®[1]. The fracture toughness (K_{Ic}) has been estimated with the help of already evaluated path independent integral using appropriate ASTM standards. Magnetization model (anhysteretic) has been assumed for the magnetostrictive material, which is specified using the Langevin function. The influence of magnetic field on fracture toughness parameters has been significant. The fracture toughness parameter has been saturated at saturated magnetization.

Reference

[1] Awani Bhushan, S.K.Panda, P. K. Singh, P. Karthik, R. Kumar, Y. Mittal, 2018 "3D Path Independent Integral for Thermoelastic and Magnetostriction Problem" 2nd Revision submitted in Mechanics Research communication Paper ID: MRC_2017_502_R1.