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Stochastic extended finite element implementation for fracture analysis of laminated composite plate with a central crack

Achchhe Lal[*†], Shailesh P. Palekar[†], Sameer B. Mulani[††], Rakesh K. Kapania[‡]

[†] *Department of Mechanical Engineering, S. V. National Institute of Technology, Surat, GJ, 395007, India*

[††] *Department of Aerospace Engineering and Mechanics, The University of Alabama, Tuscaloosa, AL 35401, USA*

[‡] *Department of Aerospace and Ocean Engineering, Virginia Polytechnic Institute and State University, Blacksburg, VA, 24061, USA*

Abstract: A stochastic extended finite element method (SXFEM), developed previously by the first two authors, has been extended for the fracture analysis along with reliability analysis of the central cracked laminated composite plate subjected to uni-axial tension with random system properties. The implemented SXFEM approach is based on the *M*-integral interaction combined with second-order perturbation technique (SOPT) and independent Monte Caro simulation (MCS) is performed for the evaluation of statistics of mixed mode stress intensity factors (MMSIFs). The random system properties such as material properties, crack length, crack angle, lamination angle, and uni-axial loading, are assumed as input uncorrelated Gaussian random variables. The effect of the different crack angles, crack lengths, lamination angles, and loading on the statistics of MMSIF in terms of mean, standard deviation (SD), probability density function (PDF) and safety factor of cracked laminated composite plate is examined along with the reliability analysis. The effect of crack propagation and its direction along with its effect on the MMSIFs is carried out through global tracking crack growth algorithm. The results obtained by present approach, are compared with an analytical solution and results available in various literature.

[*] Corresponding author- email: achchhelal@med.svnit.ac.in, Tel.: +91-0261-2201572 (o); Fax: +91-0261-2228394