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Study of the Influence of Hole Topology on Crack Propagation Rate

Authors : Hallan Moura Ladeira, Carla Tatiana Mota Anflor

Abstract : The drilling process for bolted or riveted joints of components is very common in the naval, aeronautical, mechanical, and civil industries. In this context, the present work aims to study, through computer simulation, the influence of hole geometry (through, chamfered, and rounded) on crack propagation when submitted to static and dynamic loads. For the static crack evaluation, failure was considered when the stress intensity factor (FIT) exceeds the fracture toughness of the material (KIc). In the case of fatigue, the condition of the small crack tip plastification zone and the Paris Law were considered for determining region II of the dadN x ΔK curve. Initially, a parametric analysis of the hole geometry was performed to obtain a topology that would result in less discontinuity of the stress field and, consequently, less influence on static crack growth. The best performing topology was then used to study the fatigue crack growth rate considering the Paris Law. The numerical tests were performed on a 7075-T6 aluminum specimen resulting in dadN x ΔK curves in good agreement with the literature.

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