Finite Fracture Mechanics predictions: From circular holes to penny-shaped cracks

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The work is divided into two parts. In the first one, the Finite Fracture Mechanics (FFM) criterion is employed to investigate brittle crack initiation from a circular hole in an infinite slab subjected to remote biaxial loading. Depending on the loading conditions and on the ratio between the crack advance and the hole radius, the crack propagation could reveal to be either unstable (positive geometries), or stable (negative geometries). Furthermore, it is shown that stable paths could follow unstable paths and vice-versa, leading to locally positive/globally negative or locally negative/globally positive configurations. Finally, for each configuration discussed above, the FFM predictions are compared successfully with the experimental data available in the literature and/or recently carried out, restricting the analysis to the nucleation/failure stress, for the sake of simplicity.

In the second one, the failure stress of a solid containing a penny-shaped crack is obtained. The solution is analytical up to the numerical root of the equation providing the finite crack growth increment. Results are discussed and compared with the ones provided by Linear Elastic Fracture Mechanics and by the Cohesive Crack Model.