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Defense hole design for a shear dominant loaded plate
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Abstract
Baseline data is produced for designing an optimum Defense Hole System (DHS) for a large plate with a circular hole in shear dominant-load range. Stress concentration associated with circular holes for tensile/shear ratio ranging from 0% to 25% is reduced by 13.5% to 16.67%, respectively. This reduction is achieved by introducing auxiliary elliptical holes (i.e., DHS) along the principal stress directions. Each pair lies along the same principal direction has the same geometry and placement on either side of the main hole. These holes are placed in the low stress regions. With such reduction in the maximum stress level, the improvement in fatigue life of a structural part can be very significant. Both redesign optimization and parametric optimization techniques are utilized to reach the optimum solutions and to generate the baseline data. Finite Element Analysis (FEA) is used to evaluate the stresses and to optimize the size and location of the DHS. The optimum cases are validated using the RGB-photoelasticity technique. Three main goals are achieved by introducing such holes: maximum stress reduction, working as crack arrest in case a crack propagates, and material reduction. © 2010 Imperial College Press.

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