Abstract

Plastic Collapse Load Prediction and Safety Assessment of Cracked Circular Hollow Section Uni-planar T/Y-joints and Multi-planar TT-joints

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This study concerns the safety assessment of cracked circular hollow section (CHS) uni-planar T/Y-joints and multi-planar TT-joints containing a semi-elliptical surface crack, using the failure assessment diagram (FAD) approach. Finite element analysis (FEA) is the main tool used extensively. A robust in-house mesh generator is developed to create the mesh models of the cracked CHS joints. Emphasis is put on the determination of the plastic collapse load/moment. A multi-planar TT-joint is tested under cyclic loading, and the crack propagation is monitored using the alternating current potential drop (ACPD) technique. The cracked joint is then tested to failure under axial load, and its load displacement curve is used to validate the FE models. Six strength reduction factor equations for calculating the plastic collapse load/moment of cracked uni-planar T/Y-joints and multi-planar TT-joints are proposed based on the FE results. It is also found that Option 1 FAD curve is not the lower bound for cracked uni-planar CHS T/Y-joints and multi-planar CHS TT-joints subjected to single basic load.