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A new shear and tension based ductile fracture criterion: modeling and validation

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Abstract:

A new ductile fracture criterion (DFC) is developed based on two typical fracture mechanisms - tension fracture and shear fracture by analyzing the morphologies of the fractured surfaces, and is discussed through void nucleation, void growth and void coalescence. The parameters in the proposed DFC are determined by analytical and numerical methods, and the influences of these parameters on the surface of equivalent plastic strain to fracture (EPSF) and the curve of EPSF to stress triaxiality in plane stress condition are discussed. Besides, the total Lode dependence of the proposed DFC about the influences of these parameters is also illustrated. The curves of EPSFs for Al 6061-T6 and Al 2024-T351 sheet are established and compared with the curves of CrashFEM criterion, modified Mohr-Coulomb criterion (MMC), extended Lou criterion and Hosford–Coulomb criterion and the absolute relative errors of these DFCs are also compared with the experimental data of Al 6061-T6 and Al 2024-T351, demonstrating the better accuracy of the proposed DFC. Comparative studies also show that the proposed DFC can accurately predict the ductile fractures with stress triaxiality less than -1/3, in round bar and notched bar tension.

***Keywords**:* Ductile fracture criterion; Stress triaxiality; Lode parameter; Equivalent plastic strain to fracture

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