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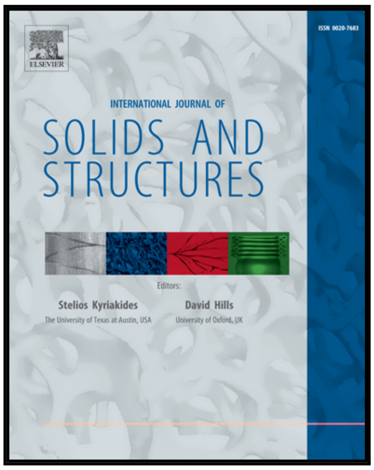

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A numerical-experimental approach to estimate cohesive laws based on continuum damage mechanics for ductile failure

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ABSTRACT

Most cohesive zone models for the simulation of crack growth in ductile metals do not reflect continuum constitutive laws on traction-separation relationships across cohesive crack surfaces. In this study, a continuously-deforming material layer associated with a ductile failure process of void nucleation, growth and coalescence is converted into a separating pair of cohesive crack surfaces resisted by cohesive tractions. Representative volume elements of damageable and undamageable material layers are used to extract the porous portion of the deformation in the failure process zone, which is reduced to a cohesive law based on continuum damage mechanics. The failure process zone height is determined by matching the *J*-integral evaluated from the results of crack growth simulations using cohesive elements with that evaluated from the displacements measured in crack growth experiments. The present approach provides an efficient and effective way to estimate cohesive laws of ductile metals by combining experimental tests and numerical simulations of a cracked specimen.

Keywords
Cohesive zone; Cohesive law; Damage mechanics; Failure process zone; Ductile failure

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