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A Cohesive Zone Model with Parameters Determined by Uniaxial Stress-Strain Curve

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Abstract : A key issue of cohesive zone models is how to determine the cohesive zone model parameters based on real material test data. In this paper, uniaxial nominal stress-strain curve (SS curve) is used to determine two key parameters of a cohesive zone model (CZM): The maximum traction and the area under the curve of traction-separation law (TSL). To this end, the true SS curve is obtained based on the nominal SS curve, and the relationship between the nominal SS curve and TSL is derived based on an assumption that the stress for cracking should be the same in both CZM and the real material. In particular, the true SS curve after necking is derived from the nominal SS curve by taking the average of the power law extrapolation and the linear extrapolation, and a damage factor is introduced to offset the true stress reduction caused by the voids generated at the necking zone. The maximum traction of the TSL is equal to the maximum true stress calculated based on the damage factor at the end of hardening. In addition, a simple specimen is modeled by Abaqus/Standard to calculate the critical J-integral, and the fracture energy calculated by the critical J-integral represents the stored strain energy in the necking zone calculated by the true SS curve. Finally, the CZM parameters obtained by the present method are compared to those used in a previous related work for a simulation of the drop-weight tear test.

Keywords : dynamic fracture, cohesive zone model, traction-separation law, stress-strain curve, J-integral
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