

A MIXED STRAIN/DISPLACEMENT FINITE ELEMENT FORMULATION SUITABLE FOR FRACTURE COMPUTATION IN COUPLED CFD/CSD BLAST AND IMPACT PROBLEMS

O. Soto¹, J. Baum¹, R. Löhner²

¹*Applied Simulations, Inc. 1211 Pine Hill Road, McLean, VA 22102, USA;*

²*George Mason University, Fairfax, VA 22030, USA*

ABSTRACT

This paper presents a mixed Strain/Displacement Finite Element (FE) approach, which has been used for fracture computation in strongly coupled blast problems. The main difference with the standard irreducible formulation (displacement based formulations) is that the strain field is one of the main FE variables of the formulation, hence, its rate of convergence is one order higher than the strain approximation from standard displacement schemes. Since the strain (or strain rate) is the main variable to compute damage and fracture of materials, a more accurate computation of such a field generates more confident results in practical problems. In addition, low order (or no order) approximation of the strain field may produce totally non-physical and mesh dependent results (i.e. irreducible formulation with linear or tri-linear elements). An additional benefit of the mixed strain/displacement formulation presented below, is that it is stable for P1/P1 (linear tetrahedral) elements, which are very attractive due to its computational cost and its relatively cheap pre-processing stage (CAD and mesh generation).