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Adaptations of Gurson-based ductile damage models for extreme dynamic loading DARBY LUSCHER, TED CARNEY, MILES BUECHLER, Los Alamos National Laboratory — There are several constitutive theories of ductile dynamic spallation ranging from relatively simple to quite sophisticated in their level of detail. Often these models are applied to a limited range of dynamic loading conditions. However, in many practical applications of dynamic material response, the material undergoes extreme shock compression such that other mechanisms are activated and confound the numerical robustness of the solution for damage evolution. We present theory and algorithmic adaptations of a Gurson-based modeling approach to address several numerical challenges. The theory is an extension of a previous model of Addessio and Johnson (1993). Implementations of Gurson-based models have used explicit or Newton-based implicit solvers, which work well with simple equations-of-state. These solvers often fail for nonlinear equations of state, e.g. with phase transformation. We present a solution strategy that is robust under large deformation within an ALE hydrocode and is compatible with general nonlinear equations of state. We demonstrate the efficacy of the approach through simulations of plate impact and explosively driven spallation experiments. Addessio and Johnson, Rate-dependent ductile failure model. J. App. Physics 74, 1640 (1993)

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