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A Consistent Approach To Stochastic Seeding of Simulations of Fragmenting Ductile Metals[1] MATTHEW BARHAM, JAMES STÖLKEN, MUKUL KUMAR, Lawrence Livermore National Laboratory — For failure by brittle fracture the well-known weakest-link arguments have led to widespread use of a two-parameter Weibull distribution. The probability of failure by a ductile damage mechanism at small plastic strains is exceedingly small. This results in a threshold for deformation induced damage and attendant failure that should be manifest in the statistical description. A three-parameter Weibull distribution with a lower cut-off satisfies this constraint. The three-parameters are determined systematically from experiments. The Weibull modulus is estimated by examining the results of scaled experiments. The values of the most-likely failure strain were inferred from simulations of quasi-static tests. The lower cut-off failure strain was estimated from the tensile test data. This approach was applied to different microstructures of AISI 4340 steel achieved through various heat treatments to determine the three parameters and constitutive response for each heat treatment. Exploding pipe simulations were run to determine fragment distributions for two explosives and each heat treatment. These simulated distributions were then compared to high fidelity experimental data for distributions of the same heat treatments and explosives simulated.

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