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EVALUATION OF THE EFFECT ON SOLUTION OF USING MODULARIZED CONSTITUTIVE MODELS IN COMPUTATIONAL FRAMEWORKS

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It is common practice to develop constitutive models subroutine in a modular fashion to facilitate implementation in a number of different codes. When the constitutive model subroutine is being verified and validated, the surrounding computational framework may influence the choice of material parameters and integrated solution. In this work, we explore the variation in results for simple canonical problems given by three different shock-physics computational frameworks that utilize the same constitutive model subroutine and material parameters. The computational frameworks that will be examined are an Eulerian Finite Difference, a Lagrangian Finite Element, and the Material Point Method. The constitutive models that will be utilized are perfect plasticity, the Mechanical Threshold Stress (MTS) model, and the Johnson-Cook model.

The Taylor Anvil Experiment is an experiment where a cylindrical specimen impacts a rigid anvil and the subsequent deformation and final geometry provides an integrated response of the specimen material. Because the final deformed state of the cylinder is easily measured post experiment, limited time-dependent diagnostics are required: the only required diagnostic being a determination of the impact velocity. This simple experiment is also favored for use as a validation problem for constitutive model development. We compare deformed Taylor cylinder profiles from experiments to our calculated ones using the three solution methods and present results as to the effect of the solution method on the final geometry.

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