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DEFLECTON OF POTENTIALLY HAZARDOUS ASTEROIDS

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ABSTRACT

Efforts have been made recently to formulate mitigation strategies to prepare for the possibility of asteroid impact on the earth. Kinetic impact is one of the many potential deflection strategies for near-earth asteroids (NEAs) on a collision course with the planet. We have performed simulations of hypervelocity impact at 6 km/s onto the secondary member of the Didymos (65803) binary system to investigate the viability of such a technique. This deflection experiment is set to occur in October 2022 as part of the DART mission.

Successful prediction of the deflection of an NEA through computational models is predicated on making reasonable assumptions for the surface and sub-surface properties of the asteroid as well as capturing the right physics of impact event. In this work we use the Tonge-Ramesh material model (TR model) for geomaterials incorporated within the Material Point Method (MPM) Uintah computational framework to estimate the momentum transfer to the asteroid and velocity distributions of ejecta produced during the impact. The TR model is a material model that can predict the damage in brittle geologic materials under impact conditions. In

conjunction with the MPM framework it allows us to make physically-based predications for the behavior of asteroid during and after the impact event. An added advantage of such a simulation can be to deepen our understanding of the formation of planetary bodies and their compositions which can in turn help us make better informed decisions for mitigation purposes.

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