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Deep Learning the Advection in Eulerian Hydrocodes PETER YEH, KI TAE WOLF, SAMUEL BOWIE, CARIANNE MARTINEZ, KEVIN POTTER, CHARLES SNIDER, MATTHEW SMITH, DAVID HENSINGER, JOHN KORBIN, Sandia National Laboratories — In Eulerian and arbitrary Lagrangian-Eulerian (ALE) hydrocodes, the time-step usually contains two parts. The first is a Lagrangian step, during which the local material cell or element is incrementally deformed. The second step is the remap step or advection step, which computes the material transport between the local elements. This remap step typically relies on heuristic algorithms that depend on neighboring solution variables. Recent developments in deep learning have shown great promise in applications or alternatives to traditional computational engineering methods. In this work, we explore the possibility of a deep learning model to mimic the remap function. Our deep neural network is trained on the nodal velocities of a structured mesh before and after the remap step in our Eulerian hydrocode. We show that our deep learning model can accurately reproduce the remap function to acceptable accuracy, and we compare speeds between our DNN and the existing remap function. This work continues to demonstrate that deep learning models can enhance numerical predictive capabilities. Sandia National Laboratories is a multimission laboratory managed and operated by National Technology and Engineering Solutions of Sandia, LLC, a wholly owned subsidiary of Honeywell International Inc., for the U.S. Department of Energy's National Nuclear Security Administration under contract DE-NA0003525.

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