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Applying Boundary Conditions Using a Time-Dependent Lagrangian for Modeling Laser-Plasma Interactions[1] J. PAXON REYES, B.A. SHADWICK, University of Nebraska - Lincoln — Describing a cold-Maxwell fluid system with a spatially-discrete, unbounded Lagrangian is problematic for numerical modeling since boundary conditions must be applied after the variational step. Accurate solutions may still be attained, but do not technically satisfy the derived energy conservation law. The size of the numerical domain, the order accuracy of the discrete approximations used, and the type of boundary conditions applied influence the behavior of the artificially-bounded system. To encode the desired boundary conditions of the equations of motion, we include time-dependent terms into the discrete Lagrangian. Although some foresight is needed to choose these time-dependent terms, this approach provides a mechanism for energy to exit the closed system while allowing the conservation law to account for the energy loss. Results of a spatially-discrete, time-dependent Lagrangian system (with approximations of second-order accuracy in space and fourth order in time) will be presented. The fields and total energy will be compared with models of the same accuracy using a time-independent variational approach as well as a non-variational approach.

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