Review of Radiation-hydrodynamics Research at AWE

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In this paper we present a review of the various computational capabilities of the multi-material radiation-hydrodynamics codes at AWE. The computational physics group at AWE has adopted a dual route strategy for the modelling of the various physical processes involved in modelling complex plasma physics experiments. Specifically, we have developed both Eulerian and ALE hydrodynamics algorithms in two and three-dimensions, the details of which are described elsewhere.

By employing operator splitting techniques, these hydrodynamics algorithms have been coupled to accurate deterministic and Monte Carlo solutions of the thermal radiation transport equations. The sophistication of the deterministic models ranges from the basic equilibrium grey diffusion approximation with a single temperature, to full multi-frequency discrete ordinate transport simulations with up to 10,000 unknowns per hydro cell.

The aim of this paper is to provide an overview of these transport algorithms, focussing on the issues associated with obtaining accurate solutions for multi-material problems. We include a comprehensive set of results for problems ranging from simplified test problems to high fidelity models of complex plasma physics experiments designed to provide a stringent test of the accuracy of the various radiation-hydrodynamics models.