ILES OF RAYLEIGH-TAYLOR AND RICHTMYER-MESHKOV MIXING

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ABSTRACT

A MILES technique (TURMOIL3D) which uses a Lagrange-remap finite difference numerical method, has been very successfully applied to a range of Rayleigh-Taylor (RT) and Richtmyer-Meshkov (RM) problems [1,2]. As these problems involve shocks and contact discontinuities, some form of MILES is considered essential to eliminate non-physical oscillations.The dissipation present in the numerical scheme is analysed. It is argued that this is relatively low and that the sub-grid dissipation can be presicely quantified.In order to demonstate the success of the MILES technique, results are compared with experimental data for shock tube mixing experiments which involve turbulent mixing superimposed on two-dimensional mean flow [3].

A spherical polar mesh option has been added and this has been used to calculate turbulent mixing in spherical implosions. TURMOIL3D is essentially an Eulerian hydrocode. However, for calculation of implosions, near-Lagrangian mesh motion is used in the radial direction and this gives a significant increase in accuracy.Results are shown for a simplified implosion (see fig.1): hydrodynamics only, with perfect gas equations of state. This involves a combination of RT and RM instabilities. The effect of mesh size is investigated and it is concluded that the averaged properties of the mixing zone are close to being mesh converged. Three-dimensional simulation of turbulent mixing in real applications is considered impractical at present. However, simplified simulations of the type shown here now make an essential contribution to the validation of the engineering models which can be used for real problems.

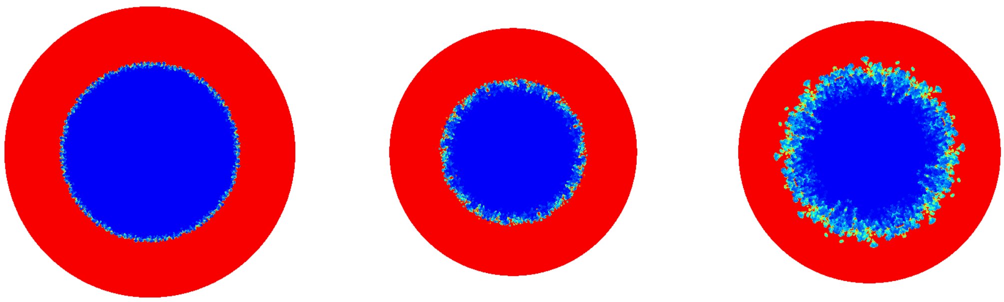

Figure 1: 2D sections through the 3D mesh for the spherical implosion, before, near and after maximum compression.

REFERENCES

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