Abstract Submitted
for the DFD10 Meeting of
The American Physical Society

A high-resolution numerical method for supercritical flows HIROSHI TERASHIMA, Japan Aerospace Exploration Agency, SOSHI KAWAI, Stanford university, NOBUHIRO YAMANISHI, Japan Aerospace Exploration Agency — We present a high-resolution methodology using a higher-order compact differencing scheme with localized artificial diffusivity for simulating cryogenic turbulent mixing flows under supercritical thermodynamic conditions. One-dimensional advection and modified Shu-Osher problems in supercritical flows are proposed to assess the performance of the present method. Results for the advection problem show that the present method is successfully applied to supercritical flows, including a trans- critical state, without any significant spurious oscillations, if initial startup errors are avoided. A localized artificial diffusivity, especially artificial thermal conductivity for temperature gradients, effectively works on reducing numerical wiggles produced due to high density/temperature gradients at interfaces. The modified Shu-Osher problem demonstrates the superiority of the present method in resolving high-frequency fluctuations as compared to a conventional upwind-biased scheme. Results for a two-dimensional cryogenic plane jet in a supercritical pressure condition also demonstrate the capability of the present method for simulating the unsteady jet flow structures and the superiority for resolving the fluctuations with reasonable grid resolutions.

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Date submitted: 05 Aug 2010 Electronic form version 1.4