Abstract Submitted
for the DFD20 Meeting of
The American Physical Society

PANS Modeling for Variable-Density Flow FILIPE PEREIRA, FERNANDO GRINSTEIN, DANIEL ISRAEL, Los Alamos National Laboratory, SHARATH GIRIMAJI, Texas AM — The prediction of variable-density (VD) flows is crucial to various problems in engineering and nature. Yet, the accurate simulation of this class of flows is challenging due to the complex physics. Thus, traditional simulation strategies are either excessively demanding (DNS and LES) or inaccurate (RANS). An efficient alternative is often needed. We present a new PANS (Partially-Averaged Navier-Stokes equations) method designed to predict VD flows efficiently. The proposed method is evaluated through the simulation of two archetypal problems: the Taylor-Green vortex at Re=3000, and the Rayleigh-Taylor (RT) flow at At=0.50. The first represents a canonical case to study transition to turbulence driven by vortex stretching and reconnection mechanisms, while the second constitutes a mixing problem driven by buoyancy effects and the RT instability. These flows are computed at distinct physical resolutions (cut-off scale) and grid resolutions. The results show that the proposed PANS method can accurately predict the two flows. Yet, this is accomplished at a lower cost than with LES and DNS. For the same degree of accuracy, the results indicate that PANS can reduce the cost of LES computations by a factor of 16 for the problems considered.

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Date submitted: 09 Aug 2020 Electronic form version 1.4