Thu4.4 Kraft & Andrews

Recovery of Rayleigh-Taylor mixing from unstably stratified flow past a cylinder

Wayne N. Kraft & Malcolm J. Andrews

Department of Mechanical Engineering
Texas A&M University, College Station, Texas, USA
wkraft@tamu.edu, mandrews@mengr.tamu.edu

An experimental investigation has been performed to study the non-equilibrium development of small Atwood number Rayleigh-Taylor mixing. Specifically, the recovery of a Rayleigh-Taylor mixing layer due to a disruption of its equilibrium by a cylindrical obstruction.

A water channel, previously used to investigate the development of Rayleigh-Taylor mixing, has been modified to include an obstruction. A splitter plate initially separates parallel streams of hot and cold water. With cold above hot, a buoyancy driven mixing layer develops. Downstream a cylindrical obstruction is located at the centerline of the mixing layer. A turbulent wake formed by the obstruction disrupts the equilibrium of the buoyancy driven mix. As a result the equilibriums of the Rayleigh-Taylor mix and plane wake interact.

Recovery of buoyancy dominated turbulence from a plane wake is characterized through measurements of velocity and density fluctuations at the centerline of the mixing layer. These measurements are acquired through particle image velocity (PIV) and a thermocouple system. These diagnostics are utilized to document the transition, and recovery to equilibrium, of the Rayleigh-Taylor mixing layer. To investigate the effects of density differences and cylinder diameter on the response of the buoyancy driven mixing layer, measurements have been taken for different Atwood and internal Froude numbers. This has led to the development of a model for the initial decay of centerline velocity fluctuations behind the cylinder.

This work has been funded by the U.S. Department of Energy from DOE Grant # DE-FG03-99DP00276/A000.