Date: September 5th

Time: 11:00 AM

Location: Ames 234

Speaker: Dr. Eliezer Kit
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Title: "Evolution of Forced Disturbances in Spatially and Temporally Developing Stratified Mixing Layer"

Abstract

Understanding of 3D effects in homogeneous and stratified mixing layer requires inter-related experimental, numerical and theoretical efforts. The experimental facility, which will allow introducing controlled 3D disturbances in the flow, is currently under construction. Here we present the results obtained at the first stage of this research that includes detailed 2D computations of a spatially developing mixing layer subject to external harmonic forcing at the splitter plate. It is known from previous studies (Gaster et al. 1985, Weisbort and Wygnanski, 1988) that coherent structures developing in the flow due to external forcing become dominant and the flow is governed mainly by their behavior. The main goal of this study was two-folded: (i) to obtain numerically the spatial evolution of primary structures of the type of K-H billows in homogeneous and weakly stratified mixing layer and (ii) to create a data base for future 3D computations of secondary 3D instabilities. Unexpectedly, new interesting features of the 2D flow instabilities have been revealed. The computational results show that when the initial thickness of the mixing layer is essential, in either homogeneous or weakly stratified layers, non-normal modes appear in the flow and are being strongly amplified although, according to the linear theory, they should decay in the course of their spatial evolution. When the forcing contains only one harmonic, the subharmonic instability and concurrent pairing occur sporadically at unpredictable locations along the developing mixing layer. It is worth noting that these locations are detached significantly from the splitter plate edge. However, the pairing becomes regular when a very small subharmonic disturbance (3 orders lower than the disturbance on the fundamental frequency) is introduced at the splitter plate.