Center for Fluid Mechanics Seminar

Dr. Thomas Peacock
Department of Mathematics
Massachusetts Institute of Technology
Cambridge, MA

Micro-Active Forcing of a Planar Jet

Abstract

The velocity profile of the planar jet was first obtained by Bickley, in 1937. Subsequent analysis revealed that the jet is unstable to two different modes, one symmetric and the other anti-symmetric about the jet centreline. This analysis, in combination with acoustic forcing experiments, resolved the issue of sensitive flames; a phenomenon first reported by LeComte, in 1858, and studied in ever more dramatic experiments by Lord Rayleigh.

With the advent of micro-technology it is now possible to perform a wealth of novel experiments in fluid dynamics. We here present the results of an experimental study in which MEMS micro-actuators were used to excite the instabilities of a planar jet. In contrast with earlier acoustic forcing experiments, we have been able to excite both the anti-symmetric and symmetric modes, and the results are compared with numerical stability calculations. As they progress downstream the modes are amplified, giving rise to large-scale vortices. These vortices entrain air into the jet and control the transfer of energy from large to small-scale motions, making them important considerations in combustion and mixing processes.

October 8, 2002
Barus & Holley, Room 159
4:00pm