3. Active Jet Control with an Array of Electromagnetic Flap Actuators*

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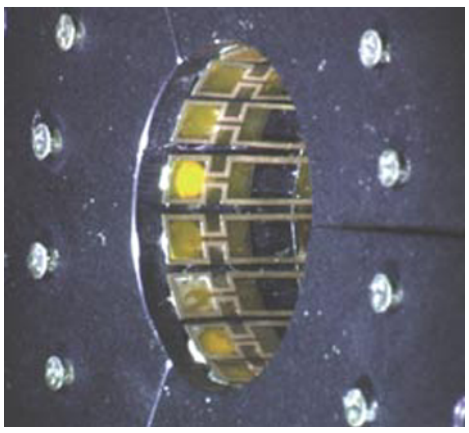
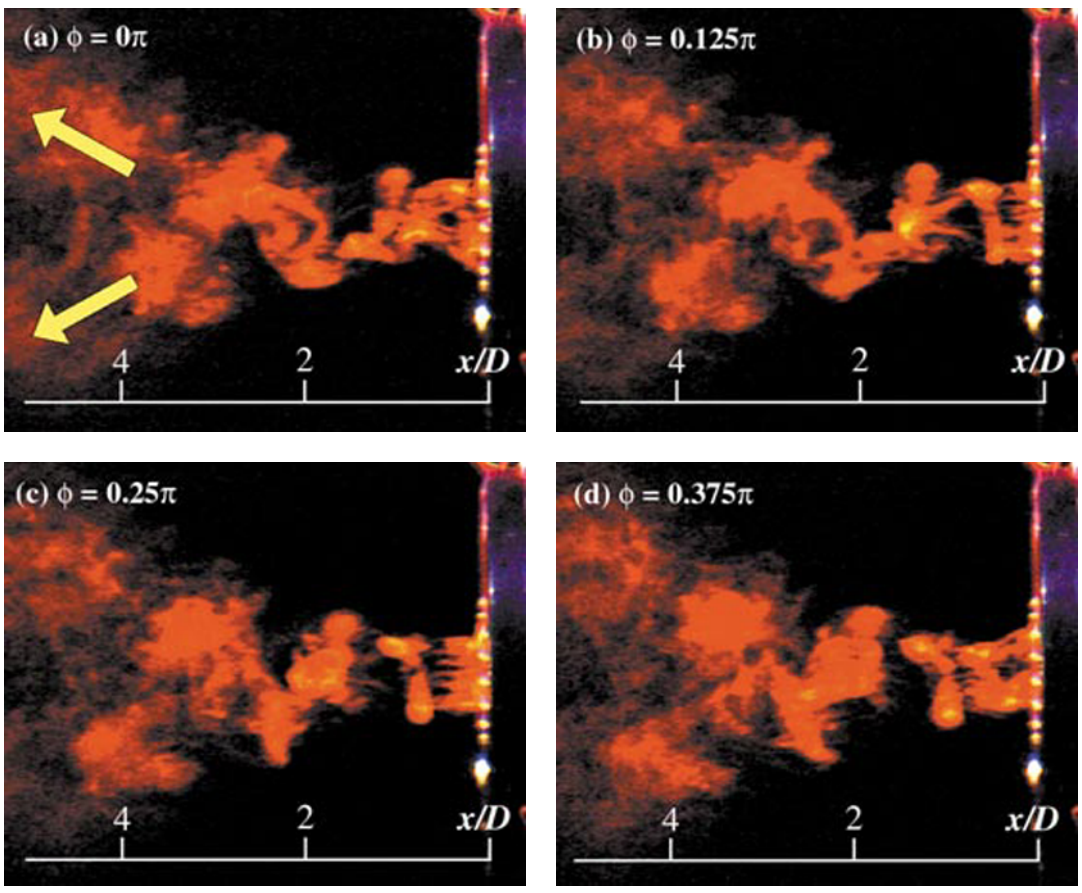


1. Perspective view of the nozzle exit (ID = 20 mm) with 18 flap actuators.

In an attempt of active control of turbulent flow with an aid of MEMS (Microelectromechanical Systems) devices, a novel axisymmetric jet nozzle equipped with a row of miniature electromagnetic flap actuators on its circular lip (Fig. 1) is developed for jet control. By applying PC-controlled driving signal to each flap, the evolution of eddy structures in the jet shear layer is modified. When each half cluster of the 18 flaps are driven out of phase (Alternative Mode), the jet bifurcates clearly into two branches owing to the mutual interaction between alternatively inclined vortex rings (Fig. 2), and mixing is significantly enhanced in the plane of bifurcation. The present control scheme is very effective, since it requires only a small amount of control input; the mechanical power input to the fluid by these actuators is by two orders of magnitude smaller than the propulsive power of the jet.



2. Successive flow visualization images of the bifurcating jet produced by the Alternative Mode control: Alternatively inclined and bent vortex rings are shed and transported into two different directions by their mutual interaction.

* Suzuki, H., Kasagi, N., and Suzuki, Y. (1999) : Manipulation of a Round Jet with Electromagnetic Flap Acutators, Proc. IEEE Int. Conf. MEMS '99, pp. 534-540.