The 2004 APS Divison of Fluid Dynamics 57th Annual Meeting
November 21-23, 2004, Seattle, USA

Bull. Am. Soc. Phys. **49** (2004) 53.

Active mixing control in a coaxial-jet

Kristian Angele, Naoki Kurimoto, Yuji Suzuki and Nobuhide Kasagi
Department of Mechanical Engineering, The University of Tokyo
Hongo 7-3-1, Bunyo-ku, Tokyo 113-8656, Japan

Abstract

A combustor model, consisting of a coaxial-jet of air and CH4, was experimentally investigated. The ultimate goal is a to stabilize the flame and minimize the emission of NOx by controlling large scale vortical structures in the outer shear layer which promotes mixing. We are utilizing 18 miniature flap-actuators positioned on the periphery of the annular jet nozzle exit, equally spaced in the circumferential direction. The flaps were driven at a frequency corresponding to a Strouhal number of unity with three different azimuthal modes: axi-symmetric, helical and asymmetric (nine neighbouring flaps were driven out-of-phase with the other nine). Phase-locked stereoscopic PIV measurements (measuring all the instantaneous velocity components simultaneously) were conducted in the cross-stream plane of the controlled cold jet at five streamwise positions, between 0.5-1.5 diameters downstream of the nozzle. Such measurements allow us to quantify the effect of the different forcing modes on the instantaneous cross-sectional structure of the jet. This is helpful in increasing the understanding of the mechanism behind an efficient mixing and a stabilized combustion, especially for non-axi-symmetric forcing.