Using the PIV method to design synthetic jet actuators and investigate non-steady-state jet flow

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We developed three designs of actuators generating synthetic jets at various frequencies, all three based on a piezoelectric diaphragm. Synthetic flows (jets featuring no mass flow rate in terms of gas) are a promising means of active flow control. Efficient use of them may reduce gas dynamic losses in transition ducts, improving aircraft power plant characteristics overall. We computed the resonance frequency and determined operation modes of said generators as regards synthetic jet formation. We used a planar method of measuring instantaneous velocity vector field, that is, PIV (Particle Image Velocimetry), for an experimental investigation of a non-steady-state velocity field when a synthetic jet flows into a flooded region, for all synthetic jet actuator design types and various vibration frequencies. We provide clear examples of synthetic jet formation for corresponding resonance frequencies of cavity vibrations in the actuator units. Using compact synthetic jet actuator units in power plant transition ducts will make it possible to decrease total pressure losses and improve engine characteristics overall.

Keywords*: synthetic jets, active flow control, PIV method, non-steady-state flow*

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