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High-magnification velocity field measurements on high-frequency, supersonic microactuators PHIL KRETH, ERIK FERNANDEZ, MOHD ALI, FARRUKH ALVI, Florida Center for Advanced Aero-Propulsion at Florida State University — The Resonance-Enhanced Microjet (REM) actuator developed at our laboratory produces pulsed, supersonic microjets by utilizing a number of microscale, flow-acoustic resonance phenomena. The microactuator used in this study consists of an underexpanded source jet flowing into a cylindrical cavity with a single orifice through which an unsteady, supersonic jet issues at a resonant frequency of 7 kHz. The flowfields of a 1 mm underexpanded free jet and the microactuator are studied in detail using high-magnification, phase-locked flow visualizations (microschlieren) and 2-component particle image velocimetry. The challenges of these measurements at such small scales and supersonic velocities are discussed. The results clearly show that the microactuator produces supersonic pulsed jets with velocities exceeding 400 m/s. This is the first direct measurement of the velocity field and its temporal evolution produced by such actuators. Comparisons are made between the flow visualizations, velocity field measurements, and simulations using Implicit LES for a similar microactuator. With high, unsteady momentum output, this type of microactuator has potential in a range of flow control applications.

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