

Abstract Submitted
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Current Control of an A.C. Plasma Anemometer for Hypersonic Flow Measurements¹ ERIC MATLIS, THOMAS CORKE, University of Notre Dame, SIVARAM GOGINENI, ISSI — A miniature 2 MHz a.c. driven, weakly-ionized plasma anemometer for measurements at hypersonic Mach-numbers has been developed. This device uses a glow-discharge between two electrodes as the sensing element. Advantages of the glow discharge to flow measurements are its native high frequency response and robust construction, compared to traditional thermally based hot-wire sensors or mems-type devices. It has a small spatial volume and can provide point measurements in flows that are optically restricted. This device has a low power requirement less than 5 Watts at 350 Vrms with 0.076 mm gap and can be used at atmospheric pressures. It requires no electronic compensation to achieve a frequency response up to its a.c. carrier frequency, produces an amplitude-modulated output that has excellent common-mode rejection with a signal-to-noise ratio better than a hot-wire, and is insensitive to temperature variations making calibration easier than thermal-based sensors. Continued development of the sensor has focused on the choice of geometry and materials of the electrodes to improve reliability and reduce size, as well as the development of a constant-current control scheme. This control method regulates the glow-discharge current in a feed-back loop to respond to changes in mean flow mass-flux.

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