CENTER FOR FLUID MECHANICS
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Numerical Simulation of a Single Emitter Colloid Thruster in Cone-Jet Mode

New Scientific missions call for emerging propulsion technologies capable of fine tuning a satellite's relative position and canceling small disturbances. One candidate technology that holds promise for these type of missions are colloidal thrusters. These thrusters are liquid electrostatic accelerators, which do not rely on gas ionization (plasma), are intrinsically small, and operate at low power levels, while having small plume divergence angles to avoid spacecraft (S/C) contamination problems.

Colloid thrusters deliver low thrust (0.1 microN/emitter, Isp = 500-7000 s) which can be multiplied many times over by integrating them in microfabricated arrays. We present a numerical simulation of a colloid thruster in an effort to complement experimental and analytical research in the area. The goal of this project has been to create a flexible numerical tool to compute single-emitter current, jet size, velocity, electric field strengths for a given geometry, fluid, flow rate, and voltage. Results are presented and compared to experimental data and analytical approximations.

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