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Analytical Model for Electrohydrodynamic Thrust RAVI SANKAR VADDI, IGOR NOVOSSELOV, University of Washington — Electrohydrodynamic (EHD) thrusters produce a thrust force by using two or more electrode to ionize the fluid and accelerated the flow in an electric field. Ionized fluids gain momentum due to the momentum transfer between charged species and neutral molecules. This phenomenon is termed as EHD flow. We extend the previously reported analytical model for EHD flow that describes the relationship between the corona voltage, electric field, and ion charge density [1] to the analysis of EHD thrust in 1D planar coordinates. The electric current density derived from the model is in agreement with Mott-Gurney law. This analytical model is compared to the experimental data [2,3] sawtooth anode to rod corona discharge in the surface boundary layer, and wire to mesh corona EHD thruster in the miniature ionocraft [4]. The model sheds new insights into the EHD thrust force and energy conversion efficiencies and can be implemented in the numerical model. [1] Y. Guan et al, Physics of Plasmas 25, 083507 (2018). [2] K. Masuyama et al, Proceedings: Mathematical, Physical and Engineering Sciences 469, 1 (2013). [3] E. Moreau et al, Journal of Physics D: Applied Physics 46, 475204 (2013). [4] E. Dedic et al, arXiv preprint arXiv:1906.10210 (2019).

Ravi Sankar Vaddi
University of Washington

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