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Plasma flows in MPD thrusters SEBASTIANO GIANNELLI, Aerospace Engineering Department, Pisa University, Pisa, Italy, TOMMASO ANDREUSSI[1], Alta SpA, Pisa, Italy, FRANCESCO PEGORARO, Physics Department, Pisa University, Pisa, Italy, MARIANO ANDRENUCCI, Aerospace Engineering Department, Pisa University and Alta SpA, Pisa, Italy — A fundamental description of the plasma acceleration process in magnetoplasmadynamic (MPD) thrusters is presented. The properties of plasma flows in self-field MPD thrusters are investigated by adopting a stationary, axisymmetric, resistive magnetohydrodynamic plasma model. First, the acceleration process in a cylindrical MPD channel is analyzed by neglecting the gasdynamic pressure term. A class of solutions is presented, which allows for a simple analytical treatment of the flow. The physical and mathematical nature of the flow is thus described in terms of two characteristic parameters: a dimensionless channel length, scaled with the plasma resistive length, and a dimensionless parameter which depends on the applied voltage. Then, the effect of gasdynamic pressure is investigated. The presented approach gives an effective description of the plasma acceleration process and defines a framework for the parametric analysis of plasma flows in MPD thrusters.

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