Fluids and Space Engineering Seminar

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Online

Challenges to Simulating Electric Propulsion Systems

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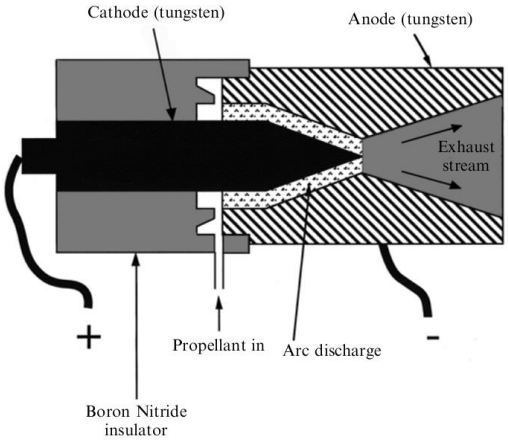
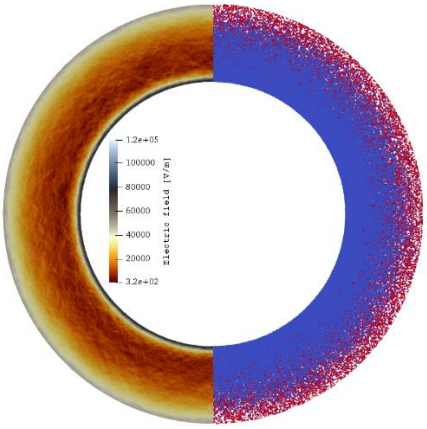


Schematic of an arcjet thruster



Electric Discharge in an 2D ring geometry (inner ring: cathode, outer ring: anode; blue dots: electrons, red dots: ions)

Electric propulsion system can provide much higher specific impulses when compared to conventional propulsion systems, which offer great mass savings and open up opportunities not only for small but also on larger spacecrafts where these systems are used for station-keeping purposes.

Arcjet thrusters are one type of electric propulsion systems, using electric arcs for heating and thereby increasing the kinetic energy of the propellant gas. Looking into literature the development of these kind of thrusters has been mostly empirically, limited numerical studies have been conducted. This is due to the complicated nature of the arcs behavior, which requires the description of plasmas which in turn give rise to several restrictions for the simulation of these systems.

This talk aims to give an overview on the Particle-In-Cell method, a simulation technique used for the description of plasma, which has been used to develop a new simulation tool based on open-source software. A particular focus on the restriction associated with this method is given. Ultimately, its application to the simulation of electric breakdowns inside arcjet thrusters are presented briefly with preliminary 2D simulations.