

MEPT Optimization

Simone Di Fede

Framework & Statement of the Problem

Innovation & Methodology

Main Expected Results

Optimization of a 50 W Magnetically Enhanced Plasma Thruster (MEPT)

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8 september 2021 1 / 11





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Electric Propulsion



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Main Expected Results

Advantages

- high specific impulse
- high thrust efficiency

State of the Art

- ion thruster
- Hall-effect thruster



MEPT: observations at system level

Observations at system level

- MEPTs do not require electrodes or grids, so they are expected to have a **very** long life
- MEPTs do not require a hollow cathode, so their **cost is much lower** than lon and Hall effect thrusters
- never tested in space, but an In-Orbit-Demonstration scheduled for 2021.







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MEPT: plasma source





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Magnetically Enhanced Plasma Thruster Optimization

Numerical-experimental approach

- numerical approach: different numerical strategies to study the different components of the thruster
- experimental approach: experimental setups to evaluate the propulsive performances and plasma properties

Numerical strategy





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Main Expected Results

Magnetic Nozzle optimization, numerical approach

General description

The numerical strategy PIC gives a consistent description of the plasma dynamics by means of:

- Integration of particles trajectories, which are determined by **Newton's law** (Lagrangian approach)
- Evaluation of EM fields on a grid (Eulerian approach)





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Experimental Setup

Diagnostic system

- Plasma source diagnostic: an optical spectrometer, a microwave interferometer and a Langmuir probe
- Magnetic nozzle diagnostic: a Faraday probe and a Retarding Potential Analyzer for plume characterization, a counter balanced pendulum to characterize the thrust









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Main Expected Results



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Results

- 50 W MEPT optimization, characterization and testing by means of a combined numerical-experimental approach
- Ophysical investigation and identification of the driving parameters for the plasma source and magnetic nozzle design
- 9 detailed numerical simulations of the two main components of a MEPT
- 4 technology exploitation

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