Paper ID: 73863
student

IAF ASTRODYNAMICS SYMPOSIUM (C1)
Interactive Presentations - IAF ASTRODYNAMICS SYMPOSIUM (IP)

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IENAI GO: A FREE TOOL FOR CONCURRENT MISSION DESIGN AND OPTIMIZATION WITH ON-BOARD ELECTRIC PROPULSION

Abstract

In-space maneuverability can significantly increase the functionality of a spacecraft, unlocking new possibilities and reducing mission costs. Extending operational lifetime, which leads to higher revenues per platform, and contributing to a sustainable space environment, by means of collision avoidance and spacecraft disposal, are examples of the advantages of carrying a propulsion system on board. This is why most microsatellites and larger platforms include one. However, the adoption rate of on-board propulsion in pico- and nanosatellites is lagging behind their substantial market growth over the last few years.

There are mainly two issues hindering the adoption of on-board propulsion, especially in sub-micro satellites. First, the absence of scalable technologies able to address the great variability of these platforms in terms of mass, power and volume constraints. Most propulsion solutions in the market are offered in small, discrete portfolios. This one-size-fits-all approach is not only far from optimal but unable to cover the needs of different missions. Furthermore, current in-space propulsion technologies are still struggling to scale down to the smallest platforms.

On the other hand, there is a lack of dedicated knowledge on propulsion and mission analysis. Pico- and nanosatellites can greatly reduce the costs of a mission, allowing smaller teams to have access to space. However, given the coupled nature of propulsion and orbital dynamics, many may not have the required expertise to understand the propulsive requirements of their mission.

To address this, **ienai SPACE** is developing a twofold solution: a scalable propulsion system based on electrospray technology, **ATHENA™**, that can address even the smallest platforms, and is optimized concurrently with the design of the mission by means of its in-house software, **GO**.

ienai GO is an open-access tool meant for preliminary design and optimization of mission and propulsion system, all in one. It solves the "inverse problem": instead of requiring a propulsion system as input to study the possibilities in a mission, it finds the optimal propulsion solution for given platform constraints and maneuver requirements. GO is based on secular dynamics, featuring high computational speed without detriment to its reliability, being benchmarked against industry standards. It is a versatile tool designed to be user-friendly, fast and robust.

GO ultimately provides insight into the impact of on-board propulsion on the possibilities and requirements of a mission, enabling the user to quickly explore very different mission scenarios and optimal propulsion configurations in preliminary design phases.