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Title

Exploring the potential of electropump feed systems for extending high thrust and deep throttle performance for CH4/LOX rocket engines

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Abstract

The development of the current European space strategy requires basic research on the key concepts of space propulsion systems that contribute to the development and consolidation of the European space industry. Due to the increasing global demand for reusable and flexible space propulsion concepts, there is a growing trend to replace turbopump systems with electric pump systems.

In order to accomplished the European space strategy, the main goal is to develop two compact electric pumps for a 25 kN LOX/CH4 bipropellant engine, in order to apply them on a number of potential applications, from placing payload on Low Earth Orbit to resupplying International Space Station. Electric pump feed system has a high potential for the future, because of their compact size and modular design with lower complexity and higher flexibility, also capable for long operations and unlimited number of restarts without any complications added to the system.

This paper is dedicated to evaluate the pumps critical points identification and solution trade-off in order to obtained sustainable overall architecture of the electro-pumps, including all the hydraulic and mechanical components necessary for their operation. In order to achieve this goal, have been evaluated several empirical methods and the preliminary pumps designs were evaluated and optimize using computational fluid dynamics (CFD) methods. Another of the key research topics is to establishment of the testing procedure and methodologies for testing the pumps by similarity with water in order to checking and validating the pumps functionality by measuring the pumps characteristics, fluid parameters and cavitation.

This scientific work is based on the project funded by the European Space Agency (ESA) in the frame of the General Studies Technology Programme (GSPT), carried on through a co-engineering partnership with COMOTI, ICPE and ROSEAL, that will bring to the project its expertise in turbomachines design and analysis, in driving motors and sealing system along with expertise of the critical function of the electrically driven pump-fed LOX/CH4 cycle rocket engine.

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