Paper ID: 63958
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IAF SPACE SYSTEMS SYMPOSIUM (D1)
Innovative and Visionary Space Systems (1)

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MECHANICAL LOW NOISE THERMAL CONTROL SYSTEM WITH FERROFLUIDS

Abstract

The demand for low noise flexible satellite thermal control systems (TCS) motivated the Center of Applied space technology and micro gravity (ZARM) at the university of Bremen and its SME partner ZARM Technik AG to develop a new TCS solution based on ferrofluids.
Initiated by a successful participation in the DLR Innospace challenge, the first project phase aimed to demonstrate the operating principles of the TCS. The two concepts followed by STMF (satellite thermal management with ferrofluids) employ different magnetic pumping schemes where mechanical vibrations are suppressed thus benefiting high precision space applications in the area of fundamental physics, geodesy and optical experiments. At the same time these technologies offer controllable pumping rates allowing for a broad range of thermal boundary conditions. This is e.g. particularly interesting for long duration missions with electrical propulsion where a significant amount of excess power has to be radiated when the target position is reached thus leading to completely different thermal requirements for mission start and operations.
The development goal is a scalable modular technology approach which offers a tool kit for a smart ferrofluid TCS. We show details of the design and verification process for a demonstrator which was set up at ZARM. Two different pumping schemes are compared as an important step towards an available technology. Our numerical approach for the design and optimisation of the experimental setups and hardware are discussed.