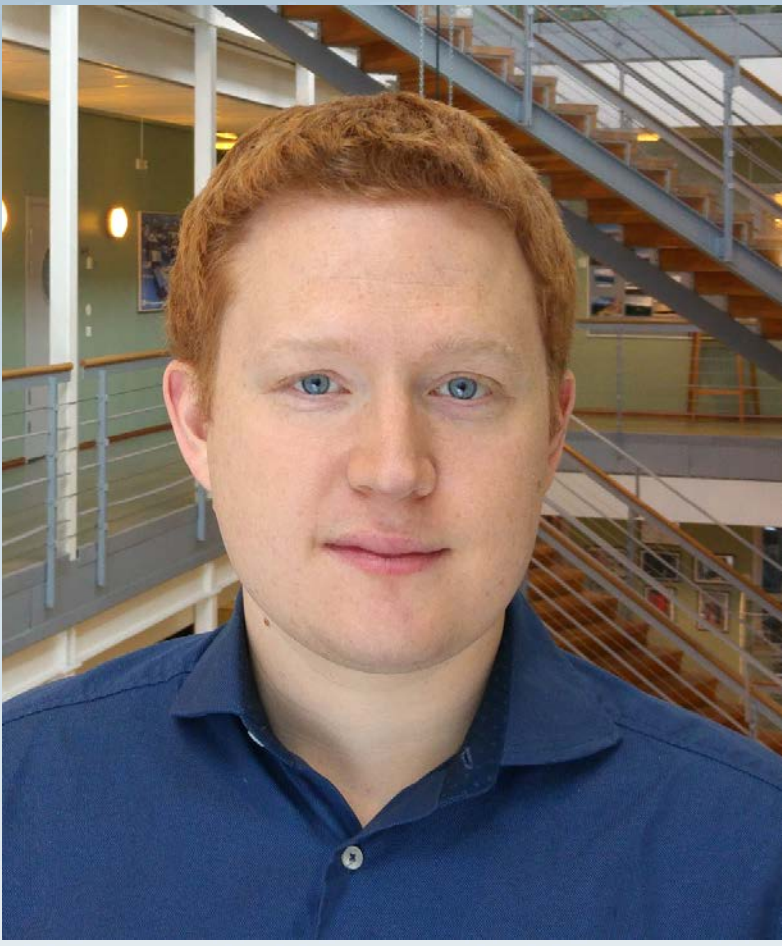


Hardware-in-the-loop Synthesis and Analysis of Spacecraft Micro-Propulsion Systems



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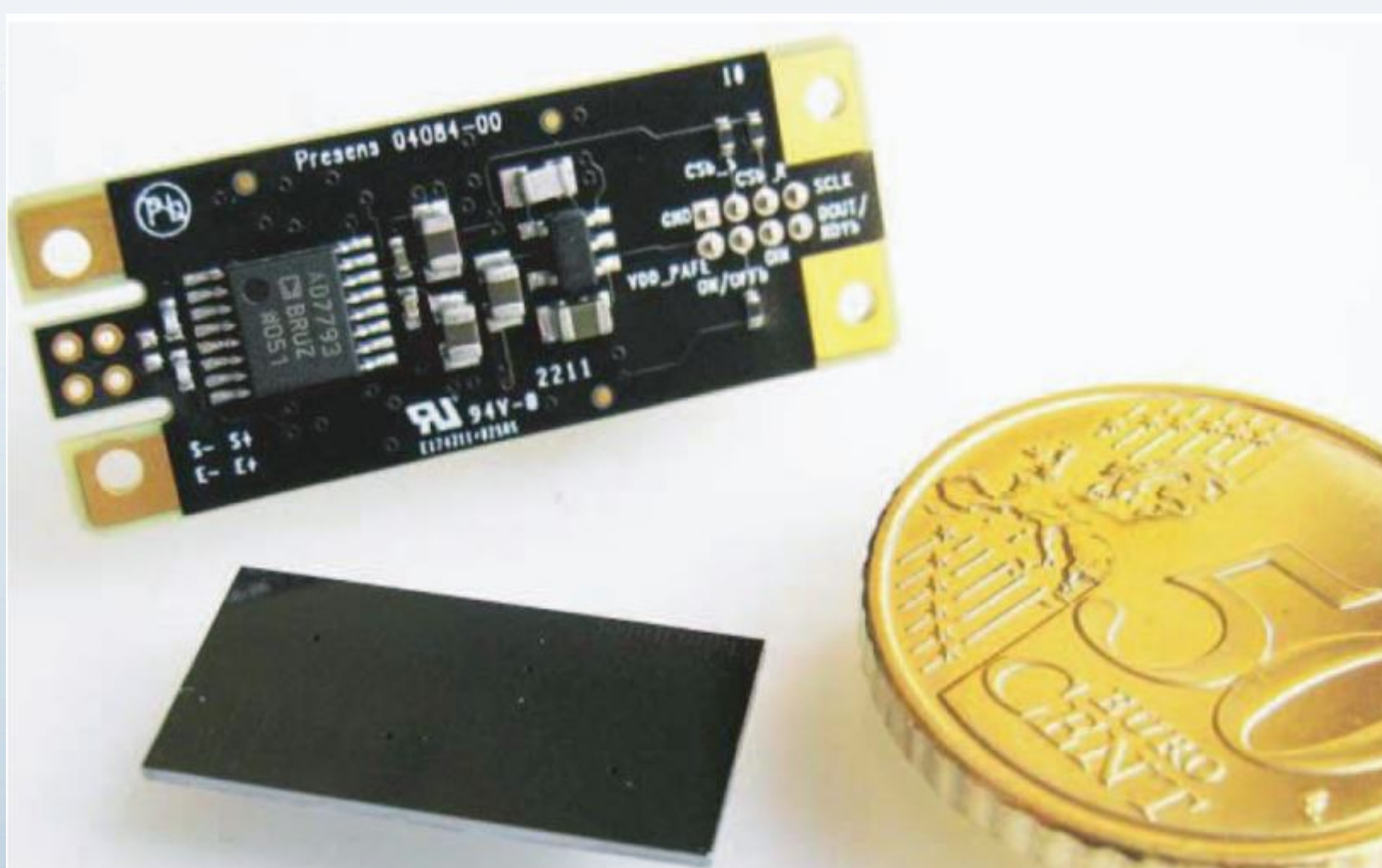
Supervisor: Professor Reza Emami

The miniaturisation trend among satellites is enabling access to space for more actors than before. The final cornerstone for such spacecraft is the inclusion of propulsion systems, which up until very recently have been missing.

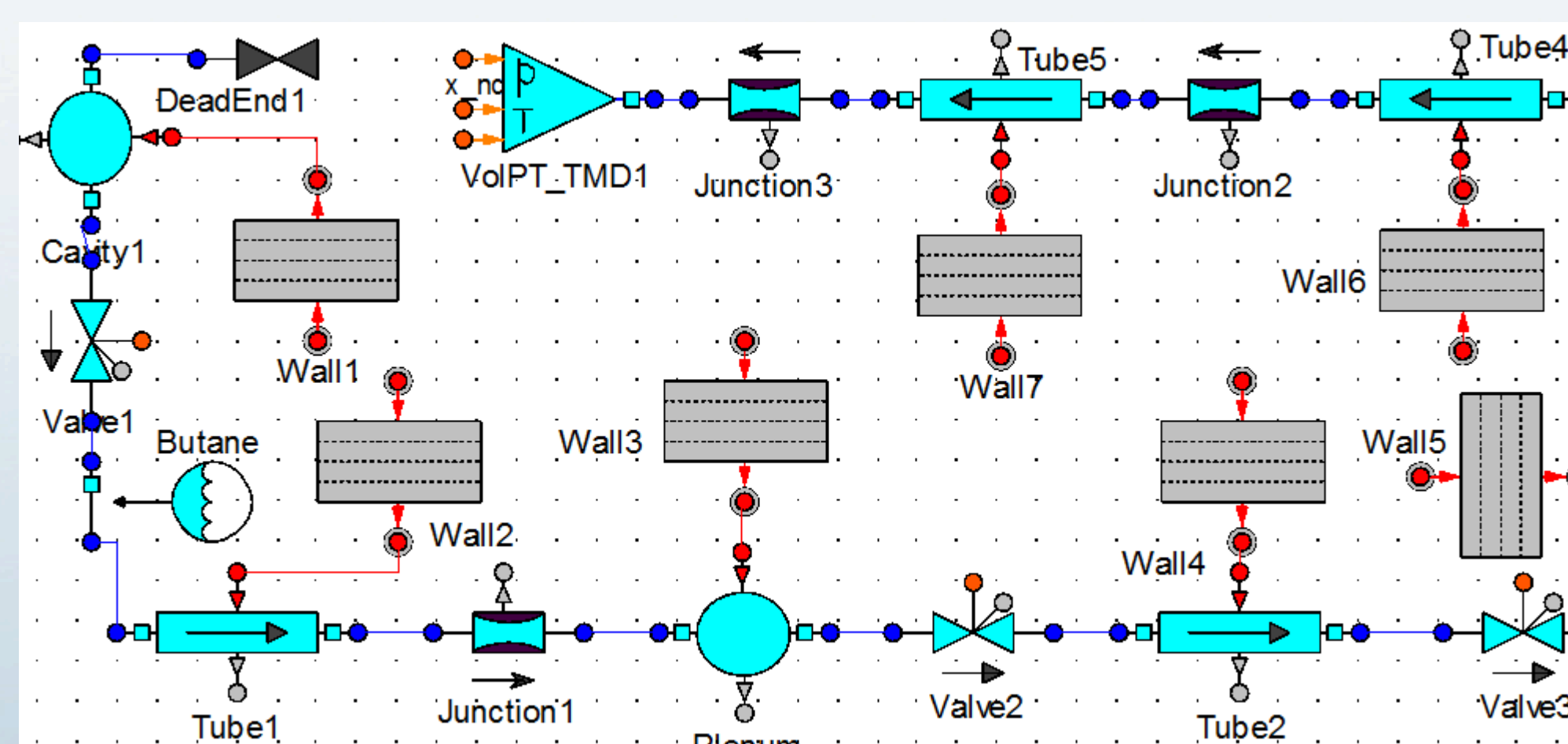
With more complex types of systems currently further down on the Technical Readiness Level ladder, cold gas systems are seen as the best compromise at the moment, especially considering that their simplistic and non-toxic nature appeals to university applications. Systems using liquefied gases such as butane are particularly interesting given their dense storage ability.

A company that is at the forefront of this task is Nanospace, of the Gomspace group. With the first version of their system already being flight-proven, and the second one currently making its way into more Cubesats, they are already well on their way. However, despite the reduced launch costs for smaller satellites, using unproven technology in orbit is still very costly, which means that more elaborate ground tests are desirable for further development.

This project is aiming at developing a hardware-in-the-loop platform in the nanosat lab at LTU's Space Campus, as a way of qualifying propulsion modules for new mission scenarios, and optimising their performance. The platform will rely on attitude actuators and sensors as physical hardware, communicating in real-time with a Simulink model simulating other aspects of the spacecraft mission. In addition to this, pure software based simulations are performed to increase the understanding of the propellant flow.



*MEMS manufactured thruster chip
along with control electronics.*



*Propulsion system model in
simulation software EcosimPro.*

In collaboration with:

NANOSPACE
A GOMSPACE COMPANY



EUROPEISKA UNIONEN
Europeiska regionala
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