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# A NOVEL NANOSATELLITE HEAT MANAGEMENT SYSTEM VIA ACTIVELY SWITCHED THERMAL PATHWAYS

**Abstract**

This paper will outline a novel thermal management system for CubeSats utilising actively switching heat-conductive pathways, as well as a lumped parameter methodology that allows the rapid design of such systems. As CubeSats become more powerful and capable, regulating their thermal status will become a growing challenge. The integration of heat-conductive pathways and actuated junctions into CubeSat structures can enable integrated control over the distribution of heat between subsystems during operation. In principle, local thermal spikes can be mitigated, excess heat can be moved to where it can most effectively be radiated away independent of spacecraft orientation. Moreover, critical subsystems can be better thermally regulated than with a passive system. These all serve to increase the reliability and capability of future CubeSat missions. Such a system would also have broad applicability to other satellite platforms as well as terrestrial use cases. Existing passive thermal systems heavily constrain the electrical and mechanical design of CubeSat platforms as the static design must withstand both the hot and cold temperature extremes over the course of the mission lifetime. An active system is potentially not only more flexible in both design and operation, but also more accurate in temperature regulation.

Due to the low-cost nature of CubeSat platforms, many missions are launched with limited thermal validation. High fidelity thermal models do not afford themselves to rapid design changes or parameter optimisation. Instead, by approaching the design as a thermal-analogue circuit, a lumped parameter model can allow for much greater flexibility and speed when quantifying mission performance, component sizing, and safety. The proposed methodology will be utilized to present the design of the thermal paths, as well as evaluating the performance benefits of the active switching system, if it were to be implemented on existing CubeSat platforms.