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HYBRID ATTITUDE AND ORBIT CONTROL OF A PICO-SATELLITE USING MAGNETIC  
TORQUERS AND AN ELECTRIC PROPULSION SYSTEM

**Abstract**

Increasing mission requirements for precise attitude pointing and size and power constraints of relevant payloads have been a major driver towards larger nano-satellite platforms over the recent years. Nevertheless, pico-satellites still promise interesting application potential for a variety of mission concepts and an increase in their performance while adhering to their specific constraints will even broaden their utilization. Precise attitude and orbit control is a key technology still to be incorporated in the pico-satellite class due to its typical size and power constraints. The University Wuerzburg Experimental Satellite 4 (UWE-4) strives to demonstrate a hybrid attitude and orbit control using magnetic torquers and an electric propulsion system in the 1U CubeSat class. Four NanoFEEP thrusters, developed at TU Dresden, are integrated into the corners of the CubeSat in order to provide precise thrust-vector pointing in combination with the magnetic attitude control system. Achievable orbit control capabilities comprise very Low-Earth-Orbit maintenance, orbit lifetime reduction of more than 40 years for orbits  $>700\text{km}$ , and even formation control while providing pointing control for potential future payloads. The contribution will elaborate on the satellite design with focus on the attitude and orbit control system and its implementation, simulation, and test. UWE-4 is currently in preparation for launch in Q3 2018.