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HIGHLY MINIATURIZED FEEP PROPULSION SYSTEM (NANOFEEP) FOR ATTITUDE AND ORBIT CONTROL OF CUBESATS

Abstract

A highly miniaturized Field Emission Electric Propulsion (FEEP) system is currently under development at TU Dresden, called NanoFEEP. The highly miniaurized thruster heads are very compact and have a volume of less than 3 cm3 and a weight of less than 6 grams each. One thruster is able to generate continous thrust of up to 8 μN with short term peaks of up to 22 μN. The very compact design and low power consumption are achieved by using Gallium as metal propellant with its low melting point of approx. 30 C. This makes it possible to implement an electric propulsion system constisting of four thruster heads, a neutralizer and the necessary electronics on a 1U CubeSat with its strong limitation in space, weight and available power.[1]

Even formation flying of 1U CubeSats using an electric propulsion system is possible with this system, which will be shown through the example of a currently planned cooperation project between Wuerzburg University, Zentrum fuer Telematik and TU Dresden. It is planned to use the NanoFEEP electric propulsion system on the UWE (University Wuerzburg Experimental) 1U CubeSat platform [2] to demonstrate orbit and two axis attitude control with the NanoFEEP system. We will present the latest performance characteristics of the NanoFEEP thrusters, the highly miniaturized elctronics and the performance of a currently developed cold neutralizer chip using Carbon Nano Tubes (CNTs).

References [1] Bock, D., Bethge, M., and Tajmar, M.: "Highly Miniaturized FEEP Thrusters for CubeSat Applications", Proceedings of the 4th Spacecraft Propulsion Conference, Cologne, May 19-22 (2014). [2] Kronhaus, I. and Schilling, K.: "Pico-Satellite Orbit and Attitude Control by Electric Propulsion", Automatic Control in Aerospace, Vol. 19. No. 1, pp. 277-282, (2013).