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THE CONCEPT OF ANTAGONISTIC SMA MICROACTUATOR FOR USE IN SPACE ENVIROMENT

Abstract

Actuators based on shape memory alloys (SMA) are widely used in the industry due to their simplicity, small size and very good power to weight ratio. So far, their main role in space missions has been the deployment of components such as solar panels and antennas. One of the reasons for this state of matter is the low energy efficiency of SMA actuators, which is the result of two factors: inherit inefficiency of phase transformations and the requirement of continuous supply of energy while maintaining a position. In this work, a new concept of an antagonistic microactuator is presented, one which aims to reduce energy consumption in a passive state. The proposed structure design is based on two mutually deforming SMA wires, providing bidirectional angular position control without the need for return springs. This paper focuses on design, construction and tests of lightweight and efficient actuator with internal measurements of wires temperature, shaft position and generated torque, as well as, on developing control algorithm. The actuator performance has been tested in conditions corresponding to ones in low earth orbit. Additionally, a concept of using presented technology during a mission of nanosatellite is presented.