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IMPACT OF STRAIN-ACTUATED ATTITUDE CONTROL SYSTEMS FOR VARIANT MISSION CLASSES

Abstract

The University of Illinois, in collaboration with NASA JPL and NASA Ames, has developed a novel attitude control system called the Strain Actuated Solar Arrays (SASA), with sub-milli arc second pointing capability. SASA provides attitude control by utilizing flexible deployable structures on a spacecraft. These flexible members are strained using piezoelectric actuators, and the resulting reaction forces slew the satellite. This momentum transfer strategy has been used for both jitter reduction and small slew maneuvers. The system is currently at a Technology Readiness Level of 5 and has an upcoming demonstration flight on the CAPSat mission. SASA has been developed with an objective to serve a wide range of missions. The technology is scalable, but ensuring a wide bandwidth of operation is challenging for different scales of vehicle structures. This study explores the potential impact of SASA on a variety of missions and satellite buses, ranging from Nanosatellites to communication and deep space satellite buses. The study will explore the potential future impact of the SASA system, as both a primary or a secondary attitude control system, for these buses. Many previously infeasible science payloads can be enabled via the precise pointing capability of SASA. The study also explores the impact of SASA on a wide range and category of science payloads, such as space observatories, gravitational wave interferometry, and Deep Space Optical Communication (DSOC). All science payloads related to fields listed in the NASA Science Mission Directorate will be evaluated, and the strengths and weaknesses of the SASA system on these objectives will be discussed.