

SPACE SYSTEMS SYMPOSIUM (D1)
Technologies to Enable Space Systems (3)

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MEMS BASED ELECTRICAL POWER SYSTEM FOR SMALL SATELLITES

Abstract

Microsystem technology has quietly made its way from university-research level to the aggressive electronics market. Advances in this field have introduced low-power, high-performance integrated technologies and enabled fast-developing highly capable small satellites for Earth observation missions. Off-the shelf MicroElectroMechanical Systems (MEMS) devices are being extensively used for different spacecraft subsystems. MEMS combine electric and mechanical structures and range in size from few micrometers to centimeters. This has led to decreased parts count as multiple systems can be developed on single chips resulting in mass production, redundancy and reduced mission costs. MEMS devices have proved to be highly efficient and reliable in vacuum conditions. Further investigation in MEMS fabrication can introduce its application for ambitious small satellite constellations. MEMS power sources can potentially replace common battery technologies in small satellites. Satellite power systems are required to be robust, ability to operate in low voltages and capable of repeated charge-discharge cycles. This paper explores the development of MEMS based power systems, ways to implement such devices in small satellites and the related constraints. Most of these are electromechanical transducers that can extract energy from its environment or by mechanical motion; others are miniaturized fuel cells and micro-machined variable capacitors. MEMS circuit breakers and converters are employed for protection and regulation of the smart power modules. However, there are many challenges to overcome in order to employ MEMS power systems in satellites, due to the specific requirements of space missions. This paper outlines a selection of systems that are feasible for application in near future and analyze their performances based on specific figures of merits such as life cycle, power required and power output.