Paper ID: 57921
oral
student

IAF SPACE SYSTEMS SYMPOSIUM (D1)
Innovative and Visionary Space Systems (1)

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PHASE-A DESIGN OF A TRIBOELECTRIC SENSOR FOR SPACE APPLICATIONS

Abstract

Power and mass budget are critical aspects of the space system design process. The constant research for new and sustainable solutions to overcome problems such as the limited amount of carriable mass and the narrow power available on-board of a spacecraft, has led to the development of compact and efficient electronics for which highly efficient power sources are needed to guarantee an independent and continuous operativity, leading to additional energy consumption.

Triboelectric Nanogenerators (TENGs) shall be particularly well suited for replacing existing sensors since, in contrast with previous technologies (i.e. acoustic transducers, piezoelectric sensors, etc.) they are self-powered and can be operated without a dedicated power supply network. As an extracurricular activity, the ARACNE student team from Politecnico di Milano supported by the University Department of Aerospace Engineering, is performing a feasibility study for the space environment of these currently undergoing research sensors. This paper follows-up on the preliminary analysis of the capability of these devices to work in harsh conditions and to be used for Structural Health Monitoring (SHM) purposes [1].

The Phase-A design of a suitable TENG for various space applications (i.e. moving object detection, SHM, harvesting energy from small motions and vibrations) is described here. By means of software simulations an extended characterization of the sensor in terms of sensitivity, sampling rate and power output is presented. Moreover, a data acquisition system is proposed and validated using simulations results. The team is still working on to better understand how results could affect the increase of the Technology Readiness Level (TRL) of such technology and its hardware.

Reference: [1] Bella S.A., Cirelli R., Romero-Calvo Á., Russo A., Ventre F., *Innovative sensor-based network for autonomous on-orbit structural health monitoring*, 70th International Astronautical Congress 2019, IAC-19-D1.1.8.x53464