

Futur Electrostatic Accelerometer without Polarization Wire for Geodesic Missions

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ONERA (the French Aerospace Lab) is developing, manufacturing and testing ultra-sensitive electrostatic accelerometer for space application. Accelerometers have been successfully developed for the Earth-orbiting gravity missions CHAMP, GRACE, GOCE and GRACE-FO and for Earth-orbiting Fundamental Physics mission MICROSCOPE.

In ONERA accelerometer design , the proof mass was levitated and was maintained at the center of an electrode cage by electrostatic forces. Moreover this proof mass was connected by a thin conductive wire (typically 5, 7 or 10 μm diameter wire). This wire allows us to polarize the proof mass and to evacuate the random charges induced by space radiation.

By removing this polarization wire, there will be positive impacts on the accelerometer defaults such as the removal of the parasitic dumping noise at low frequencies created by wire or its bias contribution; but also negative impacts which have to be precisely evaluated.

The project has started with a study of evolution of the space radiation energy distribution on interesting orbits for geodesic missions. A second step will be the study of the resulting charge distribution and its effects on a future sensor design. Finally an experimental prototype will be tested under ONERA test facilities under an equivalent space environment in order to explore different architectures to measure and control this parasitic charge phenomenon.

This project is internally funded and has been launched in mid-2018. The results of the energy distribution for geodesy missions and the status of the project will be presented.