Paper ID: 3522

MICROGRAVITY SCIENCES AND PROCESSES SYMPOSIUM (A2)
Science Results from Ground Based Research (4)

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GROUND BASED TESTS OF ULTRA SENSITIVE ACCELEROMETERS FOR SPACE MISSION.

Abstract

Both CNES MICROSCOPE and ESA GOCE mission payloads are based on electrostatic accelerometers containing a proof mass whose position is controlled in six degrees of freedom (three translations, three rotations) via electrostatic forces. Their operations rely on the very precise control of the position and orientation of proof masses. For both, the range of the accelerometer (a few 10-6 ms-2) and performance verification reasons, low gravity environment shall be created for on ground tests, this is obtained by laboratory tests on a specific platform, and free fall tests. For the laboratory tests, the proof mass shall be then suspended vertically by a specific configuration that requires the application of a high voltage (up to 1300 V). High-sensitivity tests can be however performed along the horizontal axes for the GOCE accelerometer and with specific laboratory models of the instrument produced with light masses for MICROSCOPE. The difficulty with these tests is thus the need to ensure active control of the proof mass inclination with respect to the vertical, and to provide against seismic noises. A special test bench was developed in light of this. It is a platform slaved to the horizontal by an active control of the inclination with respect to the vertical. This test facility is used for verifying functionally, extensively, the accelerometer channels by measuring the servo loop transfer functions, the electrostatic stiffness, the scale factors, the quadratic effects, and for validating the adjustment method for calibrating the accelerometers quadratic factor in orbit. The platform angular control performance defines the ground verification limits. For an exhaustive verification, as microgravity environment is the only mean to fully test the accelerometers along all the three axes, freefall tests are conducted in the 120-meter high Bremen tower in ZARM that offers 4.7 seconds of freefall under vacuum. After a global overview of the instrument and the test facilities, this paper presents some results that lead to the validation and of the instruments for the mission requirements.