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The planar electrostatic gradiometer GREMLIT for airborne geodesy and its dedicated controlled platform

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Thanks to global positioning satellites constellations and to recent space gravity missions, the knowledge of the gravity field of the Earth has been considerably improved this last decade. Nevertheless these gravity data do not address spatial resolution shorter than 90 km and airborne gravity data collection will be of the highest interest to complete them at the short wavelengths in particular in the areas where spatial distribution and quality of ground data remain quite uneven like for example land/sea transition. Taking advantage of technologies, developed by ONERA for the GRACE and GOCE space missions, the GREMLIT airborne gravity gradiometer is composed of a double planar electrostatic gradiometer with eight proof-masses in a cubic configuration, the GREMLIT instrument is mounted on a dedicated stabilized platform which is controlled by the common mode outputs of the instrument itself to achieve a sufficient rejection ratio of the perturbations/vibrations induced by the airborne environment in the horizontal directions. The levitation of the proof-masses along the normal gravity and the vibration isolation of the platform are designed to allow the instrument to support 1g $\pm$ 1g along the vertical axis. In addition to be well suited to sustain the proof-mass levitation in the Earth's gravity field, the planar configuration of each accelerometer also presents an intrinsic linearity of the horizontal control loops which minimizes the aliasing due to high frequency vibrations or motions generated outside the measurement bandwidth. Realistic simulations, based on actual data and recorded environmental aircraft perturbations, demonstrate that a performance better or equal to one Eötvös can be obtained at least along the two horizontal components of the gravity gradient. If the performance of the electrostatic gradiometer is well assessed through the experience of the space accelerometers, the overall performance has also to take into account the estimated performance of the platform associated with its additional attitude and angular rate sensors. The presentation will emphasize the principle of the platform control and how it permits to achieve such performance objective.