



The Italian Spring Accelerometer (ISA) and the BepiColombo mission to Mercury: i) physical characteristics and performances, ii) calibration and, iii) error budget

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The ambitious goals of the BepiColombo Radio Science Experiments (RSE), in terms of Mercury's gravity field and rotational rate reconstruction, as well as of the estimate of the parameters of general relativity, can be reached only using an onboard high sensitivity accelerometer. The key rôle of the accelerometer is to remove from the list of unknowns the strong non-gravitational perturbations acting on the Mercury Planetary Orbiter (MPO) spacecraft, in such a way to transform, *a-posteriori*, the MPO in a drag-free like satellite. The Italian Spring Accelerometer (ISA), developed at IFSI, has been selected by ESA to fly onboard the MPO as a category 2B instrument. ISA is a three-axis accelerometer with an intrinsic noise level of about $10^{-10} g_{\oplus}/\sqrt{\text{Hz}}$ ($g_{\oplus} \cong 9.8 \text{ m/s}^2$) in the frequency band of $3 \cdot 10^{-5} - 10^{-1} \text{ Hz}$. The accuracy required by the RSE in the orbit determination of the MPO is about 10^{-8} m/s^2 over one orbital revolution of the spacecraft (8355 s) around Mercury. This accuracy is enough to remove the disturbing non-conservative accelerations acting on the MPO surface without the necessity of their (very complex) modelling. We reassume the results of our experimental and theoretical activities with ISA during last year, with particular emphasis on the accelerometer physical characteristics and performances, on its in-flight calibration procedures and its error budget, with regard to the non-gravitational accelerations measurement.