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DESIGN OF AN ALGORITHM FOR ESTIMATION AND COMPENSATION OF STATIC AND DYNAMIC UNBALANCES OF CIMR INSTRUMENT ROTATING BODY VIA GYROSCOPES TELEMETRY DATA

Abstract

In the frame of the new generation ESA Copernicus missions, Copernicus Imaging Microwave Radiometer (CIMR) is one of the most challenging satellites in terms of required technical advancement and operational issues. The aim of such space program is to provide high-spatial resolution microwave imaging radiometry measurements of sea ice concentration, sea ice extent and surface temperature in the Polar regions. The instrument include a Large Deployable Reflector (LDR) assembly mounted on a crate (with instrument's electronics) rotating with respect to spacecraft platform. The major issues deriving from this kind of design concern the large angular momentum and static and dynamic unbalances of the rotating body which leads to nutation disturbances on the overall pointing performances of the instrument. In order to reduce this effect as much as possible, an active balancing system (ABS) of the crate has been conceived, which requires an accurate knowledge of such unbalances. To this purpose, a suited estimation algorithm has been developed, which employs the platform angular rate components sensed by the gyroscopes in order to estimate the center of mass position and the inertia matrix of the rotating part. The filter is designed and tested through a rigid multibody model. Several scenarios of possible

mass and inertia unbalances of the rotating part have been tested to assess the estimator robustness and accuracy in presence of a typical noise level in the gyroscope measurements.