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COMPENSATING EXTERNAL GRAVITATIONAL TORQUES IN A SPACECRAFT SIMULATOR.

Abstract

A servomechanical system was implemented to compensate external gravitational torques in a nano satellite simulator. Spherical air-bearing based spacecraft simulators provide a frictionless environment together with a three-axes movement. This is a classical equipment employed by engineers to verify attitude control systems in the controlled environment of the laboratory. During attitude control tests these spacecraft simulators oscillate after a control movement is applied in the X, Y or Z axis, this behavior is caused by external gravitational torques, and by axes coupling. The purpose of the servo system is to compensate these external gravitational torques using two sliding masses moving in the X, Y plane, meanwhile essays in the simulator are performed. This compensation emulates the behavior of this equipment in a microgravity environment. A dynamics model was developed, and a priori calibration of the position of the sliding masses, and its corresponding deviation angles from the horizontal position, were obtained. With this information, a microcontroller sends the adequate PWM signals to drive the sliding masses to counteract the movements caused by the actuators of the attitude control system. The final goal is to cancel, or diminish as much as possible, the external torques into the spacecraft simulator. In this case a reduction of 89