

MATERIALS AND STRUCTURES SYMPOSIUM (C2)
Space Structures - Dynamics and Microdynamics (3)

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ATTITUDE DYNAMICS AND CONTROL OF A SPACECRAFT LIKE A ROBOTIC MANIPULATOR
WHEN IMPLEMENTING ON-ORBIT SERVICING**Abstract**

The new aspect of the attitude dynamics and control for robot manipulators while performing on-orbit servicing is that they operate on non fixed bases. Even when the robotic manipulator is mounted on a spacecraft, such spacecraft is not fixed in space. The working space is characterized by the micro-gravity environment. In this environment the spacecraft fluctuates and its rotational motion may be excited by any internal and external disturbances. The complete system, i.e., the spacecraft and the associated robotic manipulator, fluctuate and is sensible to any reaction force and torque inherent to the EVA (extravehicular activities). In this sense all effort done by the robot may result in torque about its center of mass and even result in forces that can cause translational motion of robotic manipulator center of mass. This paper focuses on such scenario by analyzing the impact of the robot arms dynamics on the attitude motion. The non linear system of equations representing the robot like a robotic manipulator has been simulated through computer by using the MatLab software package. The control algorithms are tested in the Space Robotics Lab at ITA by using a 6 degrees-of-freedom floating manipulator. The PID control technique is used to keep the attitude motion stabilized while the robot arms moves its arms under the effect of gravity-gradient and applies forces to execute some hypothetical tasks. The effort to execute the work is then converted to torques affecting the attitude. The control effort is analyzed to bring about the necessary actuators to accomplish the spacecraft attitude stabilization while providing on-orbit servicing.