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MATERIALS AND STRUCTURES SYMPOSIUM (C2)
Space Structures II - Development and Verification (Deployable and Dimensionally Stable Structures) (2)

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THE EFFECTS OF THE CENTER OF MASS MOTION ON THE RELATIVE TRANSLATION AND ATTITUDE MOTION OF SPACE TUGS IN CLOSE PROXIMITY OF RENDEZVOUS AND DOCKING/BERTHING OPERATIONS.

Abstract

This paper deals with the effects of center of mass motion of a space tug, in close vicinity to berth the dock with a target spacecraft. The dynamics environment is the microgravity where bodies experience an apparent weightless scenario. Due to the Newton's law of action and reaction, the robot arm platform moves during the arm operation, affecting both the translational and rotational motions of the chaser spacecraft. In addition, the motion of the arm towards the grasping point on the target spacecraft/debris causes redistribution of mass and consequently changes in the system center of mass. The position of the chaser's CM changes and moves while the robotic arm moves. The methodology used to study this problem is the mathematical modeling of the relative motion between the chaser and target spacecraft and then simulate the equations of motion (translation and attitude) by using the MATLAB software package. The PID control technique is used in order to control the relative translation and attitude and to keep the platform stable while the arm moves. The results show that in fact, the motion of the center of mass while the robotic arm operates requires an efficient control algorithm to avoid the space tug loosing the attachment point during the last phase of the rendezvous and docking operation.