

SPACE DEBRIS SYMPOSIUM (A6)
Space Debris Removal Issues (5)

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DYNAMIC AND CONTROL OF FREE FLOATING RIGID FLEXIBLE COUPLING SPACE
MANIPULATOR DURING CAPTURE UNCERTAIN DEBRIS**Abstract**

The main issue of this paper is about the free floating space manipulator capture uncertain debris operation. The stabilization control and vibration suppression control of the rigid flexible coupling space manipulator during capture uncertain debris is presented in this paper. Firstly, the dynamical model of the free floating space manipulator system is derived with Lagrange formula; the last link of the manipulator is considered as a flexible link, one end of this link is under the constraint of a rotating hinge which connected with the previous rigid link, the other end of this link is the capture hand, this hand will combine with the debris after capture operation, base on the above constraint, the flexible link is looked as a simply supported beam, and the model of flexible link is derived with Euler Bernoulli beam theory; The debris is considered as a rigid body, the dynamic model of the debris is derived with the Newton Euler method. Secondly, base on the dynamic models of the space manipulator and debris, the impact effect is calculated from the momentum principle during the capture operation, after the successfully capture, the initial momentum of the debris has a new distribution in the space manipulator and debris combined system, this will cause the motion state of the space manipulator and debris combined system change without active control: the attitude of the space manipulator base and the joint angle will change, the components of the combined system will interfere and the flexible link will vibrate; all these will cause great harm for the space manipulator and uncertain debris combined system after the capture operation. Thirdly, the augmentation robust controller and linear quadrics optimal controller are designed, the purpose of the augmentation robust controller is to calm down state of the space manipulator after capture the debris and overcome the influence of the uncertain debris's parameter; the purpose of the linear quadrics optimal regulator controller is to suppress the vibration of the flexible link after capture the debris. Finally, the computer simulations are carried out in three cases: the space manipulator is uncontrolled after capture the debris, the space manipulator is controlled with the augmentation robust controller only, the space manipulator is controlled with augmentation robust controller and the optimal vibration suppress controller at the same time, the simulation result verify the feasibility of the above designed controllers.