NON-LINEAR JOINT DYNAMICS AND CONTROLS OF JOINTED FLEXIBLE STRUCTURES WITH ACTIVE AND VISCOELASTIC JOINT ACTUATORS

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Studies on joint dominated flexible space structures have attracted much interest recently due to the rapid developments in large deployable space systems. This paper describes a study of the non-linear structural dynamics of jointed flexible structures with initial joint clearance and subjected to external excitations. Methods of using viscoelastic and active vibration control technologies, joint actuators, to reduce dynamic contact force and to stabilize the systems are proposed and evaluated. System dynamic equations of a discretized multi-degrees-of-freedom flexible system with initial joint clearances and joint actuators (active and viscoelastic passive) are derived. Dynamic contacts in an elastic joint are simulated by a non-linear joint model comprised of a non-linear spring and damper. A pseudo-force approximation method is used in numerical time-domain integration. Dynamic responses of a jointed flexible structure with and without viscoelastic and active joint actuators are presented and compared. Effectiveness of active/passive joint actuators is demonstrated.