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NONLINEAR FEEDBACK CONTROL OF TETHERED SATELLITE SYSTEMS BY SYMPLECTIC CONSERVATIVE APPROACH

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The symplectic conservative approach for solving nonlinear receding horizon control problems was applied on the closed-loop feedback control problems of the subsatellite's deploy and retrieval process of tethered satellite system. First, the dynamic equations of two-body tethered satellite system were deduced based on Second Lagrange equations. Then the closed-loop feedback control problems of tethered satellite system were transformed into the iteration form of linear nonhomogeneous Hamilton system's two-point boundary value problems by quasilinearization method. Applying the symplectic approach on the linear nonhomogeneous Hamilton system's two-point boundary value problems, the latter can be further transformed into the solving of a set of linear equations. Finally, by updating the state and control variables on each time step, the feedback control of tethered satellite system can be completed. The numerical simulation showed that compared with the Legendre pseudospectral method, the symplectic approach has desirable computation and iteration speed when solving feedback control problems of tethered satellite system. Furthermore, the numerical simulations of the open-loop control and closed-loop feedback control problems of tethered satellite system showed that with the presence of initial errors, the open-loop control could not lead the system to a stable state, while the closed-loop feedback control can eliminate the initial errors within a certain period of time and the final state was still stable.