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APPLICATION OF LOCAL LYAPUNOV EXPONENTS TO MANEUVER DESIGN AND NAVIGATION IN THE THREE-BODY PROBLEM

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Dynamical systems theory has recently been employed to design trajectories within the three-body problem for several missions. This research has applied one stability technique, the calculation of local Lyapunov exponents, to such trajectories. Local Lyapunov exponents give an indication of the effects that perturbations or maneuvers will have on trajectories over a specified time. A numerical comparison of local Lyapunov exponents was first made with the distance random perturbations traveled from a nominal trajectory, and the local Lyapunov exponents were found to correspond well with the perturbations that caused the greatest deviation from the nominal. This would allow them to be used as an indicator of the points where it would be important to reduce navigation uncertainties. The ΔV required to return to a nominal trajectory from a random perturbation was also used in the comparison, and it was found that a relationship existed between the local Lyapunov exponents and the maximum ΔV required to return to the nominal trajectory from the random perturbation. This information has possible applications to maneuver design on unstable orbits.

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