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# NASA TECH BRIEF



## Overlapped Conic Simulation of Three-Body Trajectories

A trajectory computation technique for three-body motion has been developed based on an analytical derivation and an empirical validation of a pseudo-state theory. The technique should be of interest to astronomers and astrophysicists since it provides solutions to problems of celestial dynamics in an inverse-square force field. Application of the technique yields "overlapped conic" trajectories characterized by error magnitudes only 20 percent as great as those of patched conic trajectories. Execution time and adaptability to split boundary value problems are generally comparable, and, in some cases, the overlapped conic technique is superior to the patched conic method in both respects. Only minor changes in coding would be required to incorporate the overlapped conic simulation into existing patched conic computer programs, including those for solving split-boundary value problems.

This technique has been developed through the precise determination of a spacecraft trajectory in the earth-moon system. By this method, a general theory has been developed for using the pseudostate concept to obtain an accurate approximation of the three-body trajectory of any tertiary body having negligible mass and hyperbolic energy relative to the secondary body.

For computational ease, test cases so far have been restricted to transearth trajectories typical of nominal lunar missions. However, it is expected that the overlapped conic coordinate transformation equations described in the derivation, and the general state vector propagation algorithm implicit in their use, will yield comparably accurate results in the cases of translunar and interplanetary transfer trajectories.

### Note:

The following documentation may be obtained from:

Clearinghouse for Federal Scientific
and Technical Information
Springfield, Virginia 22151
Single document price $3.00
(or microfiche $0.65)

Reference:
NASA CR-101862 (N70-29393), A Pseudo-state Theory for the Approximation of Three-Body Trajectories

### Patent status:

No patent action is contemplated by NASA.

Source: S. W. Wilson, Jr. of
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