Paper ID: 49451
oral
student

IAF ASTRODYNAMICS SYMPOSIUM (C1)
Orbital Dynamics (2) (4)

Author: Mr. Richard Samuel
Australian National University (ANU), Australia, Richard.Samuel@anu.edu.au

A NEW METHOD OF REFINING NEAR-EARTH OBJECT CHARACTERISTICS AND BEHAVIOURS USING DIFFERENTIAL CORRECTION.

Abstract

A new method of refining the physical and behavioural characteristics of near-earth orbiting objects is being developed. The method performs orbit propagation using special perturbations and refines arbitrary-precision orbital states and characteristic parameters - mass, drag and solar radiation pressure coefficients - through differential correction until a set of constituent equations are satisfied. The method uses geophysical, atmospheric and third-body models of greater fidelity and more object characteristic parameters than are typically used in conventional orbit determination. The method is similar to cell-based engineering analyses - such as computational fluid dynamics - in that it uses constituent equations such as continuity, energy and momentum, and is solved by iterative linear algebraic techniques. In order to add determinacy to the system of equations for development purposes, the method is tested using the four accidental conjunction scenarios that have occurred to date. This paper describes the solution strategy, the input data requirements, the uniqueness of solutions and implementation issues. The results of refining the characteristic parameters of the four test cases is presented, including non-natural forces where applicable. Further applications, such as the potential to refine individual object characteristics and behaviours in isolation and the ability to identify discrepancies in established geophysical, atmospheric and third-body models is also discussed.