Mathematical Problems in Engineering

Hindawi

Special Issue on

Analytical Methods and Numerical Modelling in Modern Tasks of Space-Flight Mechanics

CALL FOR PAPERS

In space-flight mechanics the synergic use of both analytical methods and numerical models is of utmost importance. Indeed, while the analytical methods are important to understand phenomena and to provide first guess solutions, numerical models allow a high level of accuracy in the solution of problems. The modern tasks of space-flight mechanics often involve several matters, requiring the development of analytical methods and numerical modelling concerning phenomena of a different nature.

As examples of such modern tasks we can indicate analysis of perturbed motion regimes of spacecraft with obtaining exact and approximate solutions; investigation stability of attitude motion of rockets or complex spacecraft; synthesis of multibody dynamics of spacecraft with moving parts and partially filled tanks; exploration of regular and chaotic modes in orbital and attitude dynamics of spacecraft and gyrostat-satellites; construction of advanced models for solar sail propulsion; study of gravitational fields of irregular celestial bodies; and other interesting tasks of space-flight mechanics.

A significant effort is required to simulate the complex regimes of orbital and attitude motion of minor celestial bodies (moons, asteroids, and comets), to improve the speed of convergence and the optimality of the solution in several subjects (trajectories at minimum propellant consumption, attitude manoeuvres, formation flying…), and to simulate the irregular gravitational field of these bodies. In the framework of all indicated scientific directions the exact analytical and approximate numerical modelling is the primary research aspect. Accurate mathematical models allow the advanced analysis/synthesis of spacecraft dynamics and specified design of scientific orbits able to fulfill increasingly more stringent mission requirements.

All of the indicated above and new unknown aspects of research into space-flight mechanics are welcomed to the description in the framework this special issue. This special issue intends to present innovative and significant research contributions involving analytical methods and numerical modelling applied to all tasks and problems of space-flight mechanics.

Potential topics include, but are not limited to:

- Analytical solution for attitude dynamics and position of spacecraft during thrusting, spinning, or spinning up (down) maneuvers
- Perturbation methods for solution of attitude motion of spacecraft
- Heuristic methods and optimal solutions for reducing velocity pointing error
- Stability of attitude motion of rockets or complex spacecraft
- Multibody dynamics of spacecraft with moving parts and partially filled tanks
- Regular and chaotic attitude dynamics of spacecraft and gyrostat-satellites
- Dynamics of systems of variable mass/structure
- Heuristic optimization methods
- Advanced models for solar sail propulsion
- Gravitational fields of irregular celestial bodies
- Science orbits for planetary observation
- Space missions analysis

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Manuscript Due
Friday, 25 December 2015

First Round of Reviews
Friday, 18 March 2016

Publication Date
Friday, 13 May 2016