



Analytical Mechanics of Space Systems (Aiaa Education)

Hanspeter Schaub, John L. Junkins

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Analytical Mechanics of Space Systems, Third Edition provides a comprehensive treatment of dynamics of space systems, starting with the fundamentals and covering topics from basic kinematics and dynamics to more advanced celestial mechanics. The reader is guided through the various derivations and proofs in a tutorial way and is led to understand the principles underlying the equations at issue, and shown how to apply them to various dynamical systems. Part I covers analytical treatment of topics such as basic dynamic principles up to advanced energy concepts. Special attention is paid to the use of rotating reference frames that often occur in aerospace systems. Part II covers basic celestial mechanics, treating the two-body problem, restricted three-body problem, gravity field modeling, perturbation methods, spacecraft formation flying, and orbit transfers. MATLAB[registered], Mathematica[registered], Python and C-Code toolboxes are provided for the rigid body kinematics routines discussed in chapter 3, and the basic orbital 2-body orbital mechanics routines discussed in chapter 9. The third edition streamlines the presentation of material by adding additional examples, homework problems, and illustrations. It includes expanded discussion on: Numerically integrating MRPs and using heading measurements and evaluating a three-dimensional orientation; Numerically integrating the complex VSCMG differential equations of motion; The Lyapunov function and stability definitions; implementing a rate-based attitude servo control solution, and integrating an integral feedback component with a reaction wheel based attitude control, featuring new examples; developing acceleration-based VSCMG steering laws for three-axis attitude control developments; and, new Appendix I describes how to implement Kalman-Filter estimating MRP coordinates in a non-singular fashion.

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