Theory Compactification with Elliptic Functions

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Abstract

1. Two centuries of the development of analytical theories: achievements and disappointments. Place of analytical theories in contemporary celestial mechanics. Poisson series processors renaissance. Universal CAS (MAPLE, MATHEMATICA, etc.) and construction of compact analytical theories.
2. Classical perturbation theory with eccentric or true anomalies. Compactness of the disturbing function expansion and integration complications. Introducing of elliptic functions in combination with the partial anomaly technique. Pressure of numerical integration. Elliptic functions in integrable problems.
3. Elliptic function expansions as convergence accelerators of celestial mechanics series. Theta function expansions. Landen transformation.
4. Elliptic functions in planetary problems. Generating function. Intermediate orbit by Richardson. Planetary perturbations by Williams, Van Flandern and Wright. CPT (compact planetary theory) by Chapront and Simon. Combination of harmonic analysis and elliptic arguments.
5. Elliptic functions in GPT (general planetary theory). Three forms of GPT series. Compactness due to the difference of the mean longitudes. Elliptic quadratures. Higher-order treatment by means of time reversion, Hansen device and integration by parts.
6. Elliptic functions for highly eccentric orbits. Inversion problem. Perturbation theory. Resonance problem.
7. Elliptic functions for nearly intersecting orbits. Expansion of the disturbing function. Symbolic expansion with elliptic Newcomb operators. Perturbation theory.

References

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