

K05a An Analytical Theory of Motion of Nereid

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An analytical theory of motions of the second Neptunian satellite Nereid is constructed with use of Hori's canonical perturbation method. The solar perturbation, which is the dominant perturbation, is only taken into account at this stage. The small parameter is the ratio between the orbital periods of Nereid and Neptune, which is about 6×10^{-3} . The secular pert is obtained up to the fourth order and the determining functions, which eliminate short and intermediate long periodic terms, are calculated up to the third order. Since the development with respect to the eccentricity is avoided by adopting the eccentric anomaly as the independent variable instead of the mean anomaly, this analytical orbital theory can be applied to a satellite with any high eccentricity. We applied this theory to Nereid and compared the result with the orbit obtained by the numerical integration. The comparison shows that the precision is on the level 0.3 km for the semimajor axis, 10^{-8} for the eccentricity, and 10^{-5} degree for other angle variables over several hundred years.

We are going to include other perturbations such as Triton's perturbation and J_2 perturbation and then compare the analytical theory with observations and construct the analytical ephemerides of Nereid and Triton.