K01a AN ANALYTICAL THEORY ON THE MOTION OF NEREID

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The second Neptunian satellite Nereid was discovered by Kuiper in 1949. The satellite's orbit has an unusually large eccentricity(e=0.75) which is considered as the most eccentric known natural satellite. Because of its high eccentricity and generally large separation from Neptune(1.4-9.7 million km), little and may be not accurate information is available about its orbital motion and rotational properties.

In this paper, we present an analytical theory for the motion of a satellite with highly eccentric orbit and zero inclination. The solution of the equations of motion is given using Lie transformations approach in Hori's version. The solar perturbations effects are taken into account. The disturbing function is developed in powers of the ratio of the semi-major axes of the satellite and the sun and put in a closed form with respect to the eccentricity. An application on the second satellite of Neptune is considered. The secular and periodic perturbations are obtained up to the fifth and fourth order respectively. The comparison with the numerical integration of the equations of motion gives an accuracy on the level of 300 m for the semi-major axis, 3×10^{-8} for the eccentricity and 0.004 arc second for the angular variables.