A THEORY OF THE TROJAN ASTEROIDS

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ABSTRACT

The paper constructs a long-periodic solution for the case of 1:1 resonance in the restricted problem of three bodies. The polar coordinates r and θ appear in the form

$$r = r(\lambda) - m|c_k| \cos(k\omega_1 t + \phi)/D$$

$$\theta = \theta(\lambda) + 2m|c_k| \sin(k\ {}_1t + \phi)/D$$

$$\lambda = \lambda(t), \quad D = \omega_2 - k\omega_1.$$

Here λ is the mean synodic longitude, m is the small mass-parameter, k is the integer nearest to the ratio ω_2/ω_1 of the fundamental angular frequencies of the motion, and c_k is a Fourier coefficient of a certain periodic function. Only elementary functions enter $r(\lambda)$ and $\theta(\lambda)$, while the calculation of $\lambda(t)$ requires the inversion of a hyper-elliptic integral $t(\lambda)$.

The <u>internal</u> resonant terms, carrying the critical divisor D, impart to the orbit an <u>epicyclic</u> character, in qualitative accord with the results of the numerical integration by Deprit and Henrard (1970). Our solution is valid except in the vicinity of the singularities at $D = 0$ and $\lambda = 0$.

The presence of the resonant terms invalidates the Brown conjecture (1911) regarding the termination of the family of the tadpole-shaped orbits at the Lagrangian point L_3. However, this conjecture holds for the mean orbits defined by $r = r(\lambda)$, $\theta = \theta(\lambda)$, and it also holds in the limit as $m \to 0$.

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