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Title : **RESONANCE DUE TO GRAVITATIONAL INTERACTION OF TWO AXIS SYMMETRIC RIGID BODIES**

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ABSTRACT

The entire work of the thesis has been divided into five chapters.

The chapter-1 is introductory in nature, containing the history and development of the problem. To make the thesis self sufficient, we have defined some technical terms.

The chapter-2 has been divided into nine sections.

In section 2.1, we have given the brief description of the problem. In section 2.2, the equations of motion of the problem have been determined by introducing the Eulerian angles and in section 2.3, unperturbed solution has been found out with the help of the Hamilton–Jacobi theory. In section 2.4, we have calculated the approximate variational equations. In section 2.5, we have found the solution for the six Eulerian angles, by using the Lagrangian equations of motion. We have also found time of perihelion passage τ, and the argument of perihelion ω. We have seen that there are many distinct points at which resonance occur.

In section 2.6, we have investigated the resonance at one of the critical point $3n = n_A$. ($n =$ Mean motion, $n_A = \frac{\omega_A I_{A_3}}{I_{A_1}}$) for the body A. We have also determined the period $P = \frac{2\pi}{p_A}$ and amplitude of vibration $= Z_A$, where, p_A and Z_A depend upon the moments of inertia of the body and the critical argument point under consideration.

In section 2.8, we have found the solution for generalized momenta variables β_1 and β_2 which are functions of time. The time which elapses between the instants at which r attains successive minima and the corresponding change in θ has also been determined.

In section 2.9 the conclusion is drawn. We have found that θ_A, θ_B make oscillations about the same value 0 or π and $\psi_A, \psi_B, \phi_A, \phi_B$ make liberation about the value $\frac{\pi}{2}$ or $\frac{3\pi}{2}$.

In chapter-3, we have investigated the motion of the triaxial rigid bodies by taking the effect of secular terms only. This chapter has been divided it eight sections.

In section 3.1, we have given the brief description of the problem. In section 3.2, the equations of motion have been determined by introducing the Eulerian angles and in section 3.3 unperturbed solutions has been found out with the help of Hamilton-Jacobi equation. In section 3.4, we have calculated the approximate variational equations. In section 3.5, we have found the solution for the six Eulerian angles, by using the Lagrangian equations of motion. In section 3.8 the conclusion is drawn.

It is found that the semimajor axis a and the eccentricity e remain constants. The argument of perihelion, ω , and the Eulerian angles are functions of time.

In chapter-4, we have investigated the resonance due to the gravitational attraction of two axis symmetric rigid bodies in eleven different cases. This chapter has been divided into sixteen sections. This chapter gives the applications of chapter two and three. The problem has been discussed in two parts: non resonance and resonance.

In section 4.1 we have given the brief description of the problem. In sections 4.2 and 4.3 we have written the important results from chapter 2 and 3 with the help of which we have studied in all the eleven cases mentioned above. Through sections 4.5 to 4.15, we have discussed all the eleven cases. In section 4.16 conclusions are drawn.

In the non resonance case we have obtained that in all the cases except the case1 semi major axis a and the eccentricity e remain constants; $\Delta\theta$ and Δt depend on the principle moments of inertia of the bodies; r and θ depend on time of passage through the pericenter , τ , and the argument of perihelion, ω . All the Euler angles depend upon the principle moments of inertia of the bodies and are function of time but in the cases 9, 10, 11, when the body B is a rod, ψ_B, ϕ_B do not depend on principal moments of inertia of the bodies.

In the resonance case critical argument oscillates about $0 \text{ or } \pi$ in all the cases except case1.The period of liberation for the body A is given by $P = \frac{2\pi}{p_A}$ and that for B is $P = \frac{2\pi}{p_B}$,where p_A and p_B are dependent upon the critical point and the principle moments of inertia of the body .The amplitude is given by Z_A (Z_B).

In chapter-5, we have discussed the resonance in the motion of a satellite due to solar radiation pressure. This chapter has been divided into eight sections.

In section 5.1 we have given the brief description of the chapter. In Section 5.2, we have determined the equations of motion. In sections 5.3 and 5.4, we have determined the unperturbed solution and approximate variational equations respectively. In section 5.5, we have found the solution for the six Eulerian angles, by using the Lagrangian equations of motion. We have also found the time of pericenter passage τ, and the argument ω .

In section 5.6, we have investigated the resonance at one of the critical point $3n = n_B$, ($n =$ mean motion, $n_B = \frac{\omega_B I_{B_3}}{I_{B_1}}$). In section 5.8 conclusion is drawn.

We have seen that there are many distinct points at which resonance occur which depend on the mean motion and the angular velocity of the satellite .The Euler angles θ_B makes oscillation about 0 or π and ψ_B , ϕ_B the other Euler angles make oscillation about the value $\frac{\pi}{2}$ or $\frac{3\pi}{2}$. Amplitude of liberation for θ_B is $\frac{2\pi}{p_B}$ and for ψ_B , ϕ_B it is the same $\frac{2\pi}{p_{B'}}$. In the case of a satellite period of liberation undergoes a change significantly due to solar radiation pressure when we compare it with the period of liberation when solar radiation pressure is not taken into account.