Abstract of the Ph.D.Thesis

EXISTENCE AND STABILITY OF LIBRATION POINTS OF THE RESTRICTED THREE BODY PROBLEM WHEN PRIMARIES ARE TRIAXIAL RIGID BODIES

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The following problems have been studied in the thesis.

(i) Existence and stability of libration points in the restricted three body problem when the primaries are triaxial rigid bodies (when equatorial planes are coincident with the plane of motion).

(ii) Existence and stability of libration points in the restricted three body problem when the bigger primary is a triaxial rigid body and a source of radiation (when equatorial planes are coincident with the plane of motion).

(iii) Existence and stability of libration points in the restricted three body problem when the primaries are triaxial rigid bodies and source of radiations (when equatorial planes are coincident with the plane of motion).

(iv) Existence and stability of libration points in the restricted three body problem when both the primaries are triaxial rigid bodies (when equatorial planes are **not** coincident with the plane of motion).

In all the first three cases there exists five libration points, two triangular (L_4, L_5) and three collinear (L_1, L_2, L_3). Collinear points are unstable for all mass ratios whereas triangular point L_4 (or L_5) is stable for $m < m_{crit}$ where, in problem,

(i)
$$m_{crit} = 0.0385208965... + 0.81126474\sigma_1 - 1.09626653\sigma_2 - 0.02206859\sigma_1' - 0.04071097\sigma_2'$$

where $\sigma_1, \sigma_2, \sigma_1'$ and σ_2' depend upon the lengths of the semi-axes of the triaxial rigid bodies.

(ii) $m_{crit} = 0.0385208965... - 0.0089174706p + 0.81126474\sigma_1 - 1.09626653\sigma_2$.

where $p = \dfrac{F_p}{F_g}, p << 1.$

F_p = the radiation pressure force,

F_g = the gravitational attraction force

and σ_1 and σ_2 depend upon the lengths of the semi-axes of the triaxial rigid body.

(iii)
$$m_{crit} = 0.0385208965... - 0.0089174706\,p_1 - 0.0089174706\,p_2$$
$$+ 0.81126474\,s_{11} - 1.09626653\,s_{21} - 0.02206859\,s_{12} - 0.04071097\,s_{22}$$

where p_1 and p_2 depend upon the radiation pressure and s_{11}, s_{21}, s_{12} and s_{22} depend upon the lengths of the semi-axes of the triaxial rigid bodies.

In problem (iv), principal axes of the primaries are oriented with the help of Euler's angles q, f, y. The case when the primaries are nearly spherical is studied in detail. It is seen that there are again five libration points, two triangular (L_4, L_5) and three collinear (L_1, L_2, L_3). Collinear points are unstable for all mass ratios whereas triangular point L_4 (or L_5) is stable for $m < m_{crit}$ where

$$\begin{aligned} m_{crit} &= 0.0385208965... + 0.81126474\,\Sigma_1 - 1.09626653\,\Sigma_2 \\ &+ 0.28500179\,\Sigma_3 - 0.02206859\,\Sigma_1' - 0.04071097\,\Sigma_2' \\ &+ 0.06277957\,\Sigma_3'. \end{aligned}$$

where $\Sigma_1, \Sigma_2, \Sigma_3, \Sigma_1', \Sigma_2'$ and Σ_3' depend upon the lengths of the semi-axes of the triaxial rigid bodies.

In each case we have also determined short and long periodic orbits around L_4. In each case it is an ellipse and we have determined its semi-major axis (with its orientation) and semi-minor axis.

The results of (Szebehely, 1967), Vidyakin (1974), P. V. Subba Rao and R. K. Sharma (1975), Bhatnagar and Hallan (1979), Khanna and Bhatnagar (1998), Khanna and Bhatnagar (1999) can be deduced from our study.

Entire work of the thesis has been published in the form of five research papers.

(i) *Celestial Mechanics and Dynamical Astronomy* **79:** 119-133, 2001.

(ii) *Indian Journal of Pure and Applied Mathematics* **32(2):** 255-266, February 2001.

(iii) *Indian Journal of Pure and Applied Mathematics* **32(7):** 981-994, July 2001.

(iv) *Indian Journal of Pure and Applied Mathematics* **32(1):** 125-141, January 2001.

(v) *Indian Journal of Pure and Applied Mathematics* **32(9):** 1367-1390, September 2001.