MECANICA CELESTE

COMUNICACIONES

Colisión triple en un caso particular del problema restringido de cuatro cuerpos

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Resumen: Se estudia un caso particular del problema restringido de cuatro cuerpos. A partir de una solución isósceles plana (con un eje fijo de simetría), con colisión binaria del problema de los tres cuerpos con masas finitas, se regulariza una colisión triple en el problema restringido de cuatro cuerpos, introduciendo uno de masa nula. Las ecuaciones diferenciales del movimiento se regularizaron mediante el cambio de variable independiente $d\tau = \eta^{-1} dt$, siendo η una de las distancias mutuas que tiende a cero en el instante de la colisión triple.
Se demuestra analítica y numéricamente que la velocidad del cuarto cuerpo (de masa nula) tiende a cero para el instante de colisión. Luego, analíticamente el sistema de ecuaciones diferenciales está regularizado y la comprobación numérica se realizó con la computadora IBM 1620 de la Universidad Nacional de La Plata.
El trabajo completo se publicará en otro lugar.

A new method for computing special perturbations in the three-body problem.

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Abstract: In Nº 13 of the Information Bulletin for the Southern Hemisphere I have given an outline of this method.
Let there be thee mass points S = Sun, J = Jupiter, and A = Asteroid (or Satellite) and let us suppose that the orbital plane of Jupiter is taken as a fixed plane of reference in which a frame of fixed axes has been chosen in such a way that the X axis is oriented towards the perihelion of Jupiter. This system will be called "System I".
A second system of axes, "System II", is defined in the moving orbital plane of A, the X axis being directed towards the (instantaneous) direction of the radius vector $\mathbf{r}_j$ of Jupiter. The Y axis of this system is taken 90° ahead of the X axis on the moving orbital plane of A. The Z axis is (instantaneously) perpendicular to this plane.
In order to solve the problem we use the instantaneous integrals of the two-body problem in the moving plane SJA. To obtain the coordinates x and y in this plane we only need, for instance, to know the perturbed value of the radius vector $\mathbf{r}_a$ of the small body. Let us define for this purpose the equations of motion of A with respect to the system I:

$$\frac{d^2\mathbf{r}_a}{dt^2} + \mu \frac{\mathbf{r}_a}{r_a^3} = m' \left[(\mathbf{r}_j - \mathbf{r}_a)/\Delta^3 - \mathbf{r}_j/r_j^3 \right]$$

By multiplying this equation by an (for the moment) indeterminate vector $\mathbf{W}$ we immediatly obtain an equation of the form:

$$\frac{d^2\mathbf{r}_a}{dt^2} + \mu \frac{1}{r_a^2} = m' f (r_a, r_j, W)$$

This equation can be integrated by the standards methods of special perturbations. Once the value of r_a has been obtained, we adopt its value as the instantaneous value on the moving plane SJA. This can be done because the distances are invariant under orthogonal transformations in which the origin is kept fixed. System II is now the new reference system.
Formulae x = r cos v, y = r sin v can be computed by means of an iterative process. The anomaly v must be defined as usually. The connection between v and the quantities defined by the auxiliary system II is established by known formulae of elementary plane geometry. Results in system I can be obtained by the known transformation formulae or by the matrix method.

On the Application of Von Zeipel's Method to the Asteroid Valentine.

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Abstract: In Bulletin of the A. A. A. Nº 7 I have shown some previous results obtained in the application of Von Zeipel's method to the asteroid Valentine. At present I have completed the elimination of the short period terms according to Brouwer's precepts. Solutions for the six elements L, G, H, 1, g, h include terms up to the third degree in the excentricities of Jupiter and Valentine and the mutual inclination of their orbits. Some selected fourth-degree terms are to be added on account of the inequality $7n - 3n_v$. The Hamiltonian for this approximation can be easily obtained from the well known results in the theory of secular perturbations. Numerical results are being obtained by computing values of the coefficients of the analytical solutions. A programm for the 1620 IBM has been developed for this