A QUALITATIVE STUDY OF THE GENERAL CASE OF THE THREE-BODY PROBLEM OF CELESTIAL MECHANICS

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ABSTRACT

A qualitative method is being developed to construct the solution of the equations of the general problem of Celestial Mechanics. The idea rests upon the existence of such a solution. The corresponding existence theorem has been given by Poincaré when discussing Gyldén's method for solving the problem.

The main problem of Celestial Mechanics deals with the integration of a system of equations of the following form:

$$(1) \quad \frac{d^2x}{dt^2} + \frac{\alpha x}{r^3} = \frac{\partial R}{\partial x} \qquad (x = x, y, z)$$

where R is the disturbing function:

$$R = \mu\left(\frac{1}{\Delta} - \frac{xx' + yy' + zz'}{r'^3}\right)$$

The system of reference is a relative one. Its origin is placed at the center of the Sun.

The perturbation techniques provide series for the solution in power series of the masses which have been demonstrated to be divergent. However, Poincaré has pointed out that equations which have the form:

$$(2) \quad \frac{d^2x}{dt^2} - \alpha x = \mu(x, t, \mu)$$

where α is an arbitrary constant, μ is a small parameter and t the time have well convergent solutions in the case that α is a positive number and the developments depend on several "frequencies".

At the present time no method satisfies the aforementioned condition. We have tried to find a method which could fulfill such requirement. We have really succeded in finding such a statement, following Hansen's ideas. To do this we have chosen the elements in such a way that the computations of the perturbations fo the kinematic-dynamic elements are to be separated from the computations of the perturbations of the geometric elements. In the light of ideas which allow to obtain the values of the radius of convergence of the solutions of the power series in terms of a small parameter, it is possible to construct an "initial" arc, whose existence is made sure by means of the aforementioned theorem of Poincaré.

As we are dealing with motions of the most general kinds, i.e. non periodic motions, we set up the following problem. If it is possible "to cover" the whole interval of (periodic or almost periodic) variations of each element by means of a finite number of arcs, whose

existence should be made sure by means of Poincaré's theorem.

The following theorems of the theory of periodic and almost periodic functions are necessary. But we cannot say that they are sufficient.

1) Féjer theorem. It states that the Fourier series of a continuous function P (x) of period 2 π is always summable, and moreover uniformly summable , with sum P (x).

2) Weierstrass theorem. Every continuous polynomial P (x) of period 2 π can be approximated unifomly for all x by trigonometric polynomials.

3) The theorems which show that the principal theorems of the Fourier theory hold for functions which are periodic, with period 2 π and have a finite number of jumps at points 0. $\pm 2\pi$ $\pm 4\pi$, etc.

4) The statement that all these theorems are valid for functions whose periods are different from 2 π .

5) The theorems which show the existence of the almost periodic funtions i.e. that they are bounded, uniformly continuous, etc. and the very important one: Every almost periodic function f (x) can be approximated by finite sums of periodic functions uniformly for every value of x.

The problem requires a more datailed discussion for the time being. Its solutionshouldbe of capital importance in Celestial Mechanics.

BUSQUEDA DE NUEVAS ESTRELLAS VARIABLES EN LOS BORDES DEL CUMULO GLOBULAR ω CENTAURI

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Bailey (1902) encontró en ω Cen 128 estrellas variables, la mayoría del tipo RR Lyrae. En una investigación publicada por Martín (1938), esta cifra aumentó a 159 variables. Hasta el año 1956, esta cifra se incrementó en sólo 6 estrellas más. Parecía entonces que las posibilidades de descubrir nuevas estrellas variables estaban prácticamente agotadas.

En 1941, Oosterhoff, comparando el número de variables encontradas en los dos cúmulos globulares grandes Messier 5 y ω Cen, llegó a la siguiente conclusión:

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viene del trabajo anterior

Bibliography

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