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BOOK REVIEW

Integrable Systems in Celestial Mechanics, by Diarmuid Ó Mathúna, Birkhäuser, Boston – Basel – Berlin 2008, x + 234 pp., ISBN 978-0-8176-4096-5

The two fixed centers problem is positioned somewhere in between the integrable two-body problem and the non-integrable restricted three-body problem and plays the role of the natural approximation for the latter one. In the last century it turns out that this old Euler problem can be used unexpectedly in a somewhat different direction: to approximate with a enough high precision the motion of the satellite of oblate planet. And this is the key issue of the whole book under consideration.

Trying to describe the book let us start with Chapter 0, which serves as a general introduction and presents detailed historical review of the problem and its development. The author builds so to speak a "ladder" by representing the three stage evolution of an integrable description of the motion dynamics in gravitational fields of different kinds. Grades of the ladder are as follows:

$$\text{the Kepler (two-body) problem} \longrightarrow \text{the Euler problem} \longrightarrow \text{the Vinti problem}$$

which actually were formulated by Darboux as mentioned by the author (see also the review paper [1]).

Regarding the Vinti's problem which concerns the satellite altitude dynamics and to appreciate the progress, one has to consult some more detailed descriptions of the intermediate steps. One excellent book within a scope under discussion and dealing mainly with the Hamilton–Jacobi approach, its application to the perturbation theories and summarizing, among others, the results of [3–8], is that by Demin [2]. For the oblate planet satellite dynamics and the intermediate orbits, one should confine the results presented in [9–11].

The real start of the book is Chapter 1 dealing with a descriptions of a few facts from Lagrangian mechanics and Liouville systems with separable configurational variables. Then in Chapter 2 an elegant vectorial treatment of the Kepler problem follows.