Elements of Celestial Mechanics
(Elementi di Meccanica Celeste)
(2023/2024, second semester)

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1 Introduction

Celestial Mechanics is a branch of Mathematics devoted to the study of the motion of the celestial bodies on the basis of the law of gravitation of Newton. Newton's theory of universal gravitation resulted from experimental and observational facts: the observational facts were those discussed in the three Kepler laws; the experimental facts were those reported by Galileo in his book *Discourses Relating to Two New Sciences*. The basis of Newton theory came from the idea that the force keeping the Moon in orbit around the Earth is the same that, on Earth, commands the fall of the bodies.

The interesting thing is that Newton's gravitation theory allows the construction of sets of ordinary differential equations whose solutions are the time laws of motion of the bodies. If the body are two the problem is integrable, while if the number of bodies is greater than two is not.

In the first part of the course we will study in detail the 2-body problem, then we will face the circular restricted 3-body problem and we will discuss the problem of tides. In the second part we will deal with the regularization of the 2-body problem, with the planetary equations of Lagrange and Gauss, and we will show how to describe the Earth as a rigid rotating body.

2 Practical Information

The course will last 48 hours, and it will take place in the second semester. The exam will be an oral examination on the topics discussed during the lectures.

The prerequisites for this course are the skills acquired in the first/second year courses in Mathematics, Physics or Aerospace Engineering.

Whoever is interested in knowing more about this course can contact us via e-mail:
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