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Title: *"On the linear stability of some periodic orbits of the N-body problem with the symmetry of platonic polyhedra"*

Abstract. In the last few years many interesting periodic orbits of the classical Newtonian N-body problem have been discovered as minimizers of the Lagrangian action functional, on a particular subset of the T-periodic loops in H^1. The interest in this classical problem was revived by the numerical discovery of the now famous figure-eight solution of the three body problem, by C. Moore in 1993. In 2000 A. Chenciner and R. Montgomery rediscovered this particular orbit, giving a formal proof of its existence using the direct method of calculus of variations. The figure-eight is a first example of a N-body choreography, that is a solution in which N equal masses chase each other around a fixed closed curve, equally spaced in phase. Moreover, T. Kapela and C. Simó (2007) and G. Roberts (2007) independently proved the linear stability of such orbit, using numerical methods.

In this presentation we want to study the linear stability of periodic orbits with the symmetry of the Platonic polyhedra, in which N coincides with the order of the rotation group of the polyhedra. The particles have all the same mass and the orbits found are invariant under the rotations of the group. The existence of such orbits is given by G. Fusco, G. F. Gronchi and P. Negrini (2011), still using variational methods. In the first part we see how to set up an algorithm in order to find all the different sets on which we are able to state the existence of a minimizer of the action functional. This algorithm gives us a list of periodic orbits that we have to examine. In the second part we describe a numerical method (proposed by C. Moore and M. Nauenberg) that permits us to obtain an approximation of the motion. In the last step, we describe how we can correct such approximation using a shooting method, and how we can state the linear stability or instability of our orbits. However, we will see that these orbits are all unstable.

Joint work G.F. Gronchi.