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Extending the Property of a System to Admit a Family of Oscillations to Coupled Systems

V. N. Tkhai * and I. N. Barabanov

V. A. Trapeznikov Institute of Control Sciences of Russian Academy of Sciences, 65 Profsoyuznaya str., Moscow 117997, Russia

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Abstract: Coupled systems, each one admitting a family of nondegenerate periodic solutions, are considered. The period of oscillations in the family is supposed to depend on a unique parameter. Conditions imposed on weak couplings such that the coupled system admits a family of periodic solutions, which is similar to that of subsystems, are found. Differential equations of general form, as well as reversible mechanical systems are investigated. The existence of resonant orbits in the N-planet problem with one planet in a quasi-circular orbit is proved.

Keywords: *coupled system; differential equation; periodic solution; family; nondegenerate; reversible mechanical system; N-planet; resonant orbits.*

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1 Introduction

Investigation of a dynamic model usually implies the consideration of substantial factors. The influence of other (minor) factors is regarded in the frame of the perturbation theory. This influence can either slightly change quantitatively dynamical characteristics of the system, or bring about a new quality. The latter case is usually associated with a bifurcation.

System perturbations result from weak influence of other systems. Taking this into account we consider a new model, which is closed one. The non-regarded influence is modelled by the couplings between the systems to constitute coupled systems. Since the intensity of non-regarded factors is weak, the couplings are expected to be small.

In [1] the closed model containing coupled subsystems (MCCS) is introduced. This model posesses dynamical properties (i.e. run-outs, enregy transfer, etc.) that cannot

* Corresponding author: mailto:tkhaivn@yandex.ru

