

On solutions corresponding to Grioli's precession in the problems of dynamics of a rigid body with a fixed point

Natalia V. Khlistunova, Institute of Applied Mathematics and Mechanics of National Academy of Science of Ukraine.

ABSTRACT

Determination of sufficient conditions for the existence of solutions of systems of nonlinear ordinary differential equations can be particularly complicated for problems on dynamics of a rigid body with a fixed point when the ODE systems have a large dimension and a large number of parameters is involved to characterize the mechanical configuration of the considered system of rigid bodies.

The exact Grioli solution for the classical problem of rigid bodies mechanics which was stated by L.Euler corresponds to the regular precession motion of the body around an oblique axis. In this paper the sufficient conditions of existence of the Grioli solution are obtained for the motion of a gyrostat in Newton gravity field and a constant homogenous magnetic field. The new case of integrability of the motion system of equations is derived for the problem of the motion of a free rigid body with symmetric rotor in unlimited volume of ideal incompressible liquid. These particular solutions are the generalizations of the known classical cases by virtue of the fact that the precession axis and the proper rotation axis are not perpendicular all the time. The comparative analysis of sufficient conditions of the existence of the Grioli solutions is done for detection of some general properties of motions.

Keywords: *exact solution, invariant relation, gyrostat, precession motion*

Mathematics Subject Classification: *34A55, 34C30, 70B10, 70E15*

Contact Address: `nat@iamm.ac.donetsk.ua`