Computer Algebra methods in Qualitative Analysis of Mechanical Systems

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Abstract

The talk presents some results of qualitative analysis of Kirchhoff's differential equations describing motion of a rigid body in ideal fluid in Sokolov's case. In this case, the equations have 4 algebraic first integrals (three quadratic ones and one 4th degree integral) and represent a completely integrable system. With respect to these equations, a problem has been stated to obtain stationary solutions, stationary invariant manifolds and to investigate their properties in the aspect of stability. The research methods are based on a combination of classical methods of rigid body dynamics, Lyapunov's classical results and computer algebra methods. In particular, methods of computer algebra implemented in the computer algebra system "Mathematica" have been used. Combination of these methods allowed us to obtain rather detailed information on qualitative properties for above classes of solutions of the equations.