

New dynamical properties of symmetric gyroscopes system

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ABSTRACT

It is well known that a classical problem of motion of an absolutely rigid body with a fixed point and its various generalizations are relative to main objects for investigations in the analytical mechanics. Essential nonlinearity and a higher order of motion equations, a great of numbers of used parameters as well as external simplicity of this idealized problem attract attention of numerous researchers but its sufficiently complete solution is not obtained to present time. Therefore finding of exact solutions remains the important direction for investigations because the detection of their common properties permit to understand properties of the general solution. In this paper a system of n heavy symmetric gyroscopes coupled sequentially by ideal spherical hinges is considered. The new class of nonstationary exact solutions for motion equations of this system is found. It contains majority from known exact solutions of the problem. The mechanical system motions when axes of symmetry of some bodies are collinear to the vertical axis and axes of other bodies are in vertical plane and they make equal angles with vertical correspond to the constructed solutions. New form of motion equations of the rigid bodies system is derived. It has made possible the construction of these new solutions. Necessary and sufficient conditions of existence of the solutions are obtained and they are analyzed. Thanks to this results a classification of the gyros motions having such structure is given and new dynamical properties of the gyroscopes system are determined.

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