Analytical Method for Describing the Dynamics of Mechanical Systems in Variable Time Intervals

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Abstract

Within the framework of the linear model of the fluctuating time interval, there has been developed an analytical method for the statistical description of the dynamics of mechanical systems in variable time intervals of passing the fixed coordinates by the systems' elements. We obtained the linear relations between the displacement variations and variations of time intervals for rotational, vibrational, and reciprocating motion in different coordinate systems. We also analytically assessed the influence of the type of motion and coordinates of fixed positions on the variations of time intervals. The research shows the possibility of restoring the true values of the displacement variations from the variations of the current oscillation period by multiplying each period variation value by the appropriate scale factor, which takes into account the coordinate of the fixed angular position. We found the system correlation functions and the frequency characteristics of transformations of the displacement variations in variations of the time intervals. On their basis, we analyzed the transformation features in the time and frequency domains. The advantages and disadvantages of measuring the current period, the current time interval and the current time for the experimental study of the dynamics of mechanical systems are determined. The study shows that the scope of linear relations depends on the type of motion and the choice of coordinates of the fixed positions and is limited to the level of relative variations of the period of no more than 10%.

Keywords

Mechanical system Fixed coordinate Displacement fluctuations Time interval fluctuations