

## عنوان مقاله:

Application of the method of multiple scales for nonlinear vibration analysis of mechanical systems with dry and lubricated clearance joints

## محل انتشار:

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## خلاصه مقاله:

In this study, the method of multiple scales is used to perform a nonlinear vibration analysis of a mechanical system in two cases; with dry and lubricated clearance joints. In the dry contact case, the Lankarani-Nikravesh model is used to represent the contact force between the joined bodies. The surface elasticity is modeled as a nonlinear spring-damper element. Primary resonance is discussed and the effect of the clearance size and coefficient of restitution on the frequency response is presented. Then, a frequency analysis is done using the Fast Fourier Transform. A comparison between the Lankarani-Nikravesh and Hunt-Crossly contact force models is made. The results obtained numerically and analytically had an acceptable agreement. It is observed that decreasing the clearance size changes the frequency response in the primary resonance analysis. Furthermore, Hunt-Crossly contact force model showed a slightly more dissipative effect on the response. In the lubricated joint case, a linear spring and a nonlinear damper based on the Reynolds equation developed for Sommerfeld's boundary conditions are used to model the lubricant behavior. It is shown that only the fluid stiffness has influence on the amplitude of the steady state response and the fluid does not make any effect on the response frequencies after the transient response vanishes. The steady state response frequency for both dry and lubricated cases depends on the linear natural frequency corresponding to the pendulum oscillation. In the primary resonance analysis, increasing the dynamic lubricant viscosity decreases the amplitude in the vicinity of the linear natural frequency as expected.

## کلمات کلیدی:

Lubricated joints, Clearance, Method of multiple scales, Primary resonance, Fast Fourier Transform

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