SIMULATION OF HIGH STATIC LOW DYNAMIC STIFFNESS (HSLDS) USING HARMONIC BALANCES METHOD

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With the Selawat and Salaam to our lovable Prophet Muhammad SAW.

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ABSTRACT

In engineering application, vibration isolator is significantly important to reduce the vibration. Unfortunately, most of the vibration isolator that commonly used today is limited by the mount stifmess to support a static load. Many of researchers try to improve this system by incorporating a negative stiffness element in the mount such that the dynamic stiffness is much less than the static stifmess. This combination is called High Static Low Dynamics Stifmess (HSLDS) mount. The aim of this project is to verify the experimental work done by Alessandro Carrella (2008) entitled "Passive Vibration Isolators with High-Static-Low-Dynamic-Stiffness" by simulating the system using Simulink. To achieve this objective, the benefit of HSLDS system is study. From the HSLDS the force and stifmess displacement is expressed in cubic polynomial. Then, the system is presented in the form of Duffing equation. In this thesis, only a first-order nonlinear analysis is carried out. Harmonic balance method is used to solve the equation of motion when the system is subject to a harmonic excitation. The main feature of the dynamic response of a Duffing oscillator is the jump phenomenon (include jump-up). Jump phenomenon occurs because of the existence of bifurcation points at which the system response 'jumps' from one stable branch to another. The parameter used to evaluate the effectiveness of the isolator is the transmissibility. In order to shows the benefits offered by the HSLDS isolator, the transmissibility of the HSLDS and a linear isolator is plotted on the same graph. Duffing equation and harmonic balance equation are modeled by using Simulink to prove the jump phenomenon. Then, from the jump phenomenon graph, analysis is carried out in order to compare the HSLDS isolator with the linear isolator.

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