Spring design of a vibration isolator using a parallel mechanism

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Abstract

This paper presents the spring design of a vibration isolator using a parallel mechanism. The proposed vibration isolator consists of six identical legs, each made of two straight links connected via two orthogonal springs. The main advantages of this vibration isolator are that it can provide a large stroke and a wide range of applied payloads, making it appropriate for most industrial applications. The link and spring parameters of the mechanism are determined through an analytical approach based on the dynamic equations. In this work, the design concept, modeling, analysis, and numerical examples are presented in detail. Through the numerical investigation, it is found that the amplitude of an input signal can be nearly canceled with the spring design, with a wide range of frequencies from zero to infinity. When the base is excited with acceleration, the moving platform of the vibration isolator obtains a much smaller value of acceleration as compared to that of the base. The obtained result demonstrates the effectiveness of signal isolation of the proposed spring design. Moreover, this work also investigates the effect of the input parameters of the isolator which allows us to find the optimal parameters for the vibration isolator to achieve the best performance.