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Abstract
At present, the high-tech industries have become ultra-precise. All kinds of manufacturing equipment and inspection equipment are required stricter vibration requirements. When the environmental vibration exceeds the requirements of the precision equipment, the technology of vibration control is the best solution to overcome the vibration problem of this equipment. There are two types of vibration control systems: One is the active isolation system; the other is the passive isolation system. The later is simpler than former and it provides better performance in the high frequency range. However, the active isolation system is used to improve the isolation performance in the low frequency range. Furthermore, the active isolation system can be divided into the hard-mounted system and the soft-mounted system. The hard-mounted isolation system provides excellent performance in the isolation of environmental vibration and the elimination of the effects of direct payload disturbances. Therefore, the hard-mounted isolation system performs very well in the precision equipment with moving parts.
This research is to investigate the hard-mounted isolation system together with the sliding-mode control algorithm. Because sliding-mode control algorithm has the advantages of robustness and optimization, the developed hard-mounted isolation system is able to isolate the environmental vibrations and reduce the influence of the direct disturbances on the isolated platform. In this research, piezo-electrical actuators are used as the actuating elements. First, the equation of motion is derived for the hard-mounted system. Then, the sliding-mode control algorithm for this system is developed. Finally, numerical simulations are performed to verify the feasibility of this system. Based on the results of numerical simulations, it has been shown that the transmissibility and compliance of this hard-mounted isolation system with sliding-mode control algorithm are much lower than those of the hard-mounted isolation system with the conventional PID control.
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