National Institute of Technology Rourkela

Progress Seminar

Seminar Title	: Design and Analysis of Integrated QZS Vibration Isolation System
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Venue	: CAD Lab
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Abstract	: In response to the increasing demand for compact vibration isolators in precision sensing instruments and medical devices, a quasi-zero stiffness (QZS) vibration isolator based on multi-arc based curved beams is proposed. The isolator is composed of multi-arc curved beam units, along with a base, platform, fixture, guide rail, and linear bearings. A static model of the multi-sectional curved beams is developed to analyse the force&ndashdisplacement relationship, and a QZS configuration is obtained through parameter optimization. Compression tests validate that the multi arc curved beams achieve QZS characteristics. The harmonic balance method (HBM) is employed to solve the dynamic equations of the nonlinear system, yielding analytical solutions for displacement transmissibility. Frequency sweep experiments conducted show an initial isolation frequency of approximately 3.9 Hz, with a 90% isolation effect at 8.3 Hz. The experiment results also demonstrate the QZS isolator&rsquos good isolation performance and useful consideration for real-world application. The multi-arc based curved beam's simple structure allows for easy customization to meet varying load requirements, enabling multiple vibration isolation configurations by adjusting the beam assembly. The pro-posed QZS isolator with multi-sectional curved beams demonstrates significant potential for low-frequency vibration isolation in precision applications.