STRUCTURE-BORNE SOUND PROPERTIES OF WIRE ROPE ISOLATORS

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1. INTRODUCTION

Traditionally, a wire rope isolator provides insulation designed to meet low-frequency requirements, while its structure-borne sound properties remain arbitrary. Furthermore, wire rope isolators are frequently used for shock isolation applications. However, increasing interest in noise abatement has heightened the need for effective isolation within the audible frequency domain, requiring structure-borne sound property data from the source, the vibration isolator and the receiving structure. In this proceeding, the wire rope isolator's audible stiffness is focused upon, displaying measurements results.

2. RESULTS

The dynamic stiffness magnitude versus frequency at vanishing preload is shown in Figure 1, using logarithmic scales. Clearly, the magnitude is rather constant up to approximately 700 Hz, where it increases sharply. The peak at 1000 Hz is an anti-resonance. The peak is rounded; indicating rather high damping – contrary to those of ordinary steel springs – and, thus, is displaying similar behavior as rubber isolators. The main reason for the increased damping is the friction motion between the separate threads of the cable twist.

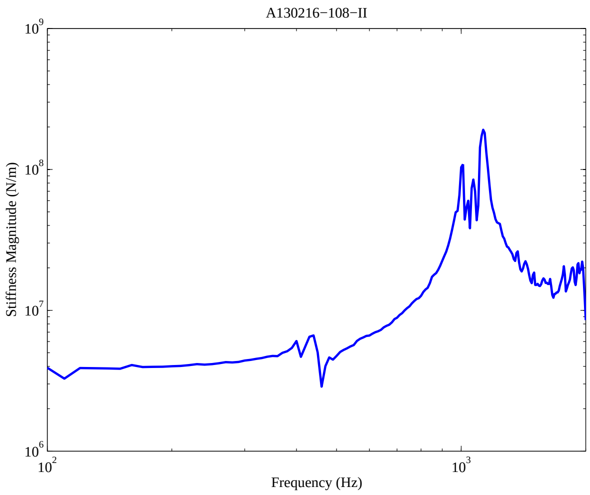

Figure 1. *Stiffness magnitude versus frequency.*

3. CONCLUSIONS

A specially designed test rig at the Marcus Wallenberg Laboratory for Sound and Vibration Research is utilized for measuring the dynamic stiffness of the wire rope isolator within the audible frequency range. It is shown that the low-frequency stiffness up to 700 Hz is rather frequency independent while is displaying a strong dependence on the frequency above 700 Hz where the anti resonance peak magnitude is rounded; indicating rather high damping – contrary to those of ordinary steel springs – and, thus, is displaying similar behavior as rubber isolators. The main reason for the increased damping is the friction motion between the separate threads of the cable twist. Furthermore, the stiffness is independent on vibration amplitudes typically applied within the audible frequency range, while showing a substantially lower stiffness for significantly higher amplitudes, typically applied for low-frequency applications. Finally, the dynamic stiffness is displaying a strong static preload dependence; the higher the preload, the lower is the stiffness. In conclusion, wire rope isolators – typically applied for shock isolation and low-frequency applications – may also be suitable for noise and vibration applications within the audible frequency range, contrary to ordinary metal springs.