

Viscoelastic Tuned Mass Dampers

Viscoelastic tuned mass dampers (TMDs) use viscoelastic (VE) material as the suspension element, in such a way that the material exhibits the functionality of both the energy dissipation device (*viscous*) and the restoring device (*elastic*). These tuned mass dampers are in general less costly than the more commonly used TMDs employing viscous dampers and a springs in the make-up of their suspension.

Viewing the configuration, amount, geometry, and type of the VE material as design variables, DEICON optimally designs, using finite element analysis, VE TMDs so that their elasticity along with their mass yields the desired tuning frequency and their viscous attribute provide the required energy dissipation. A sample of the analyses leading to the design of the VE TMD is presented in Figure 2 depicting the distribution of the shear deviatoric stress (the main damping mechanism), in the VE material making up the suspension.

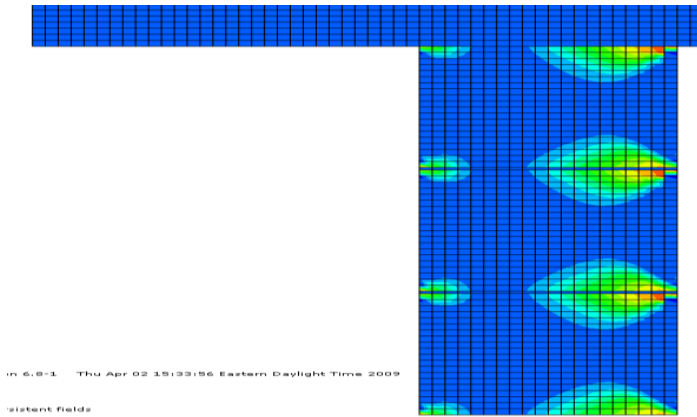


Figure 2 Distribution of shear stress

Figure 3 depicts a 100 lb and the solid model of a 500 lb viscoelastic tuned mass damper.

Tuned mass dampers are highly effective vibration treatment devices commonly used for dampening the vibration of a structure at a particular resonant frequency. Such dampers are made up of a mass/inertia, a restoring mechanism (normally a spring), and an energy dissipating mechanism (normally a viscous damper); see Figure 1. In most TMDs, the restoring mechanism and the energy dissipating mechanism, making up the suspension, are realized by two individual elements/devices.

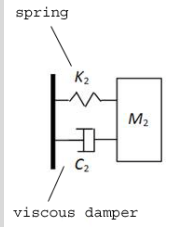


Figure 1 A TMD Schematic

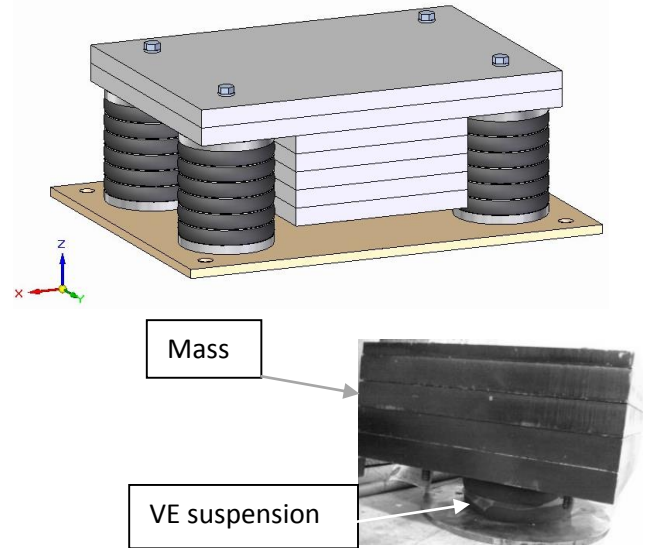


Figure 3 Viscoelastic tuned mass damper (VE TMDs)

Figure 4 shows the measured and numerically evaluated frequency response functions (FRFs) for the 100 lb TMD shown in Figure 3. Clear from the flatness of the FRFs around the natural frequency, shown in Figure 4, VE suspension is providing more than adequate damping for VE TMD. The tuning frequency (in Hz) of these dampers varies in single digits which correspond to the frequency range of interest for large applications such as floor (and other large structures) vibration damping.

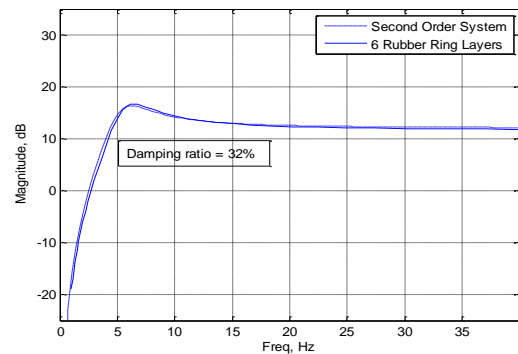


Figure 4 Measured and identified FRFs of a VE TMD