PASSIVE VIBRATION DAMPERS

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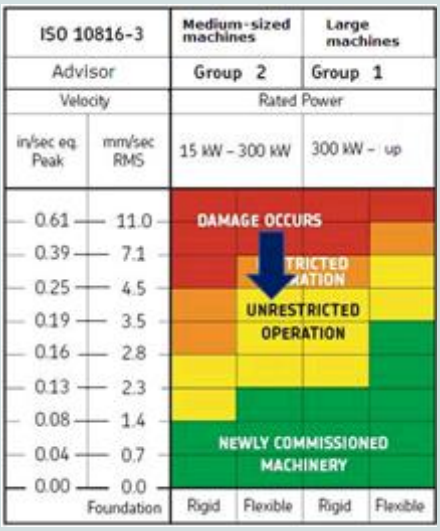
THE VIBRATION SINK

Experiencing excessive vibrations in sensitive mechanical structures or rotating machinery? Tuned Mass Dampers (TMD) and Tuned Mass Absorbers (TMA) provide a simple and effective solution to reduce them.



TARGET SITUATIONS WHERE PASSIVE ABSORBERS ARE EFFECTIVE

Mechanical structures

- Isolating the structure from excitations coming from the ground is not possible or is not sufficient
- Increasing the system stiffness to reduce the vibration levels is not possible (too stiff, too heavy etc.)
- The internal damping cannot be increased
- For fixed excitation frequency applications: use of a Tuned Mass Absorber
- For variable excitation frequency applications with a transient speed running over mechanical resonances: use of a Tuned Mass Damper
- For wideband/random excitation: use of a Tuned Mass Damper
- For structures subjected to shocks: use of a Tuned Mass Damper

Rotating machinery

- Balancing of the rotating equipment has been performed but is not sufficient
- Alignment of the rotating equipment has been performed but is not sufficient
- The mechanical suspension is already well balanced
- The structure mechanical resonances cannot be modified
- For fixed rotation speed applications: use of a Tuned Mass Absorber
- For varying rotation speed applications, with a transient speed running over mechanical resonances: use of a Tuned Mass Damper

TYPICAL USE

- Rotating machinery vibration reduction when alignment and balancing does not achieve adequate results.
- Wind turbine gear box vibration/noise emission reduction
- Piping vibration
- Excessive structural vibration excitation during ramp-up or slow-down (stirring machine, flywheel, etc.).
- Time-to-stabilization improvement when decelerations cause structural oscillations (e.g. robot arm, inspection machine with moving camera, etc.).

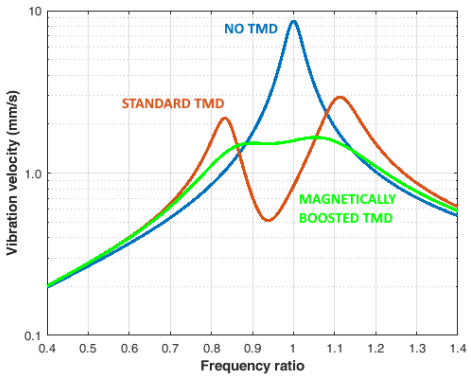
IN SUMMARY

TMA address static harmonic vibrations while TMD address non-stationary harmonic vibrations.

The vibration damping effect of a TMD is generally smaller than that of a TMA but it is global, whereas the effect of a TMA is larger but limited to a frequency band.

WHAT IS A TUNED MASS DAMPER?

The Tuned Mass Damper (TMD) consists of damped mechanical oscillators. The effect of this damper is to replace the lightly damped resonance by two attenuated resonances. The damping effect depends directly on the mass ratio between the mass of the target structure and that of the TMD. Typically, a mass ratio of about 5-10% is recommended. For high frequency applications, a dedicated magnetic damper is used to obtain optimal results, that is the magnetically boosted TMA.



WHAT IS A TUNED MASS ABSORBER?

Tuned Mass Absorbers (TMA) consist of undamped mechanical oscillators. The effect of this damper is to absorb vibrations in a frequency band around its own resonance frequency. The width of the absorption band depends directly on the mass ratio between the mass of the target structure and that of the TMA. Typically, a mass ratio of about 5-10% is recommended.

YOUR BENEFITS

- Vibration reduction with a TMD or TMA is a non-intrusive process. No structural modification is needed. The TMD or TMA is simply attached to the apparatus and damps or kills vibrations. The device does not degrade the static strength or stiffness of the target structure. Performance with TMD or TMA is an additive process, so the more devices you attach to the structure or machine, the more vibration reduction is obtained.
- TMD equipped with our Magnetic Booster allows for optimum damping of the device, increasing its effective damping and/or reducing the size of the damping system.
- TMA or TMD are fully passive and do not require any energy supply, they simply need to be tuned to the respective target resonance or excitation frequency.
- Micromega Dynamics has more than 20 years of experience in the design, manufacturing and installation of TMD and TMA.

CUSTOMIZED DESIGN

While TMD/TMA technology has been around for many years and a TMD/TMA is conceptually a very simple device, each implementation requires specific attention (TMD/TMA weight, tuning frequency, available space & mechanical interfaces, manufacturing costs, thermal environment etc.).

Therefore, Micromega Dynamics provides support in:

- the vibration diagnostic and requirement specifications
- the selection of the TMD/TMA arrangement
- the commissioning of the TMD/TMA
- the periodic check of TMD/TMA operation (typically once a year)

EXAMPLES

Example #1: A 75kW water pump motor experiences excessive vibration levels (up to 11mm/s RMS) due to the presence of a structural resonance in the mechanical supporting structure (see below). The frequency of this structural resonance lies within the operating range of the variable speed motor, leading to significant vibration amplification. When the motor frequency varies and sweeps over this resonance frequency, the vibration is amplified to unacceptable levels. Thanks to the TMD, the structural resonance was significantly reduced.

Example #2: Some Wind turbines experience tonalities, harmonic sound protruding from the background noise, due to mechanical vibrations, especially the gearbox. Because of these tonalities the wind turbine velocity must be limited, which involves reducing the produced electrical power. Thanks to TMA mounted on the gearbox, the mechanical vibrations were restrained locally and were not transformed into acoustic noise anymore, leading to the recovery of the nominal productivity.

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