

OBJECTIVE

The PM900M proof mass damper from CEDRAT TECHNOLOGIES aims at reducing resonance within structures. It consists of an actuator that accelerates a load in one direction. When attached to a structure, the generated force counteracts external vibrations.

Coupled with CEDRAT TECHNOLOGIES linear amplifier LA75 and controller, the PM900M provides a compact solution for active vibrations control.

STRUCTURE

The architecture of the device is composed of 5 main parts (Fig.1): An amplified piezo actuator (APA), a counter mass, an accelerometer, a guidance and a mechanical interface with the vibrating structure.

The PM900M is based on standard amplified piezo actuators. The APA utilises the metallic shell to amplify motions from the piezo stack and to pre-stress it (Fig.2). This pre-stress is required to withstand large external vibrations. An additive mass at the top of the actuator places its resonant frequency in a range where vibrations provided by the environment is important.

Amplified Piezo Actuators (APA) are relevant for designing active dampers thanks to:

- High energy density per mass & volume
- Preloaded actuators able to bear vibrations
- Low manufacturing costs

PERFORMANCE

Typical performances are measured when coupling the PM900M to a cantilever beam on a test bench (Fig.3).

Results on a large bandwidth are given in the following graph (Fig.4):

This study shows:

- The possibility to use the PM900M with a simple analog controller to provide an active proof mass.
- The stable behaviour of the PM900M in closed loop.
- The ability to reduce the vibration on a structure with several modes.

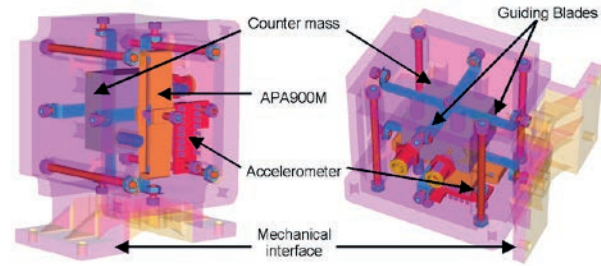


Fig. 1: PM900M Proof mass damper mechanical design

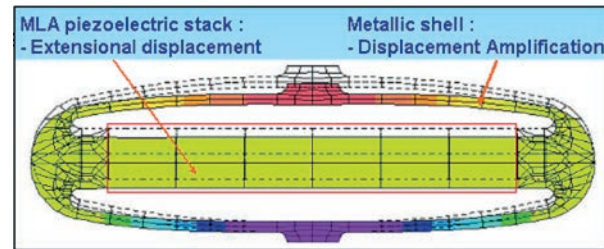


Fig. 2: FEM Modeling of the APA Structure at rest & Deformed structure.

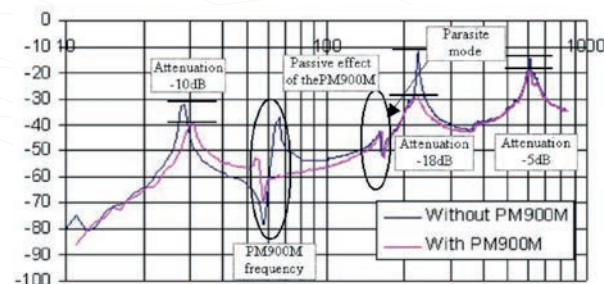


Fig. 3: Spectrum analysis: Acceleration amplitude (dBVrms) Vs Frequency (Hz).

Other proof mass dampers can be designed by CEDRAT TECHNOLOGIES using its design tools, lab facilities and technological know-how.

The PM900M development was made in the frame of the 6th FP MESEMA project.

APPLICATIONS

Vibrations are critical in many industrial fields where they can be damped thanks to APA: Automotive, Semiconductor, Air & space, Machine tools...

In summary, PM900Ms offer:

An easy mounting on existing structure, simple interface and compact device

- No impact on the structural stiffness
- Great damping with low additional weight
- Robustness & compliance with industrial requirements
- No gravity compensation, “sky hook” active damping strategy

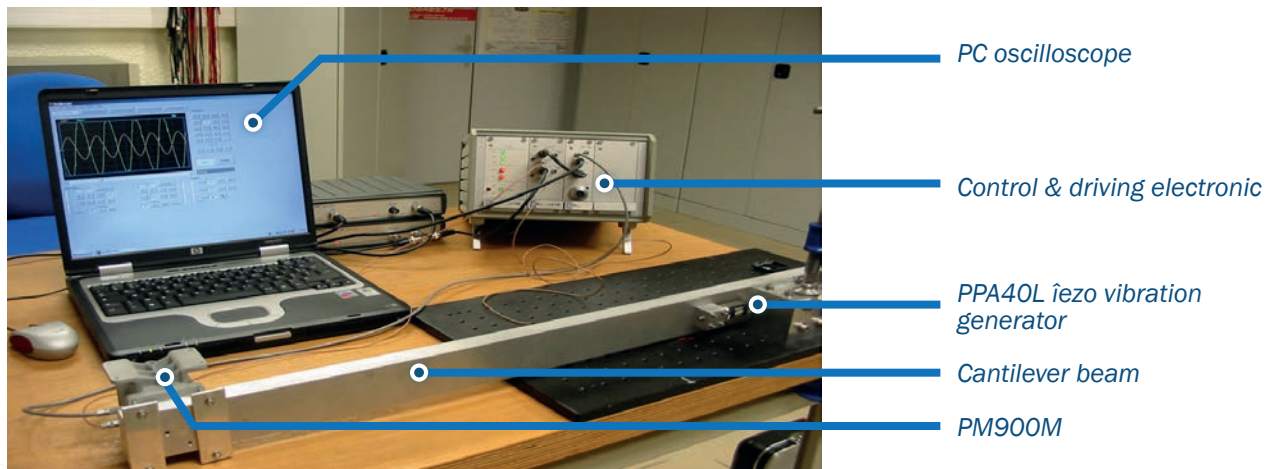


Fig. 4: PM900M coupled to a cantilever beam; experimental set up.