Self-powered SSDI enhanced by energy harvesting module

Voltage in anti-phase with velocity

- In the SSDI, the voltage on the piezo is in anti-phase with the velocity, so that the resulting force counteracts the vibrations of the structure.
- The dissipated energy is proportional to \( \frac{1}{1+\gamma} \). The quality factor of the switch \( \gamma \) is crucial for achieving high damping performance.

Self-powered implementation

- The efficiency of the switch is critical for high damping performance.
- The energy required for the switch is harvested from an additional piezo.
- Minima and maxima detection obtained by a low pass filter.

Testing and results

Experimental assembly

Vibration reduction measurements

Loss factor – coupling coefficient diagram

Conclusion and outlooks

- Completely autonomous switching shunt with high damping performance and robust to changes in natural frequencies of the structure has been developed.
- Very good agreement between analytical prediction and experimental values for the loss factor.
- Importance of the concurrent design of stiffness and damping.

References