

bandwidth. The reason for this behaviour is the smaller amplitude of the last PECs due the smaller beam deflection with the reduced tip mass. Fig. 6 shows the increasing of the bandwidth dependence on the number of cantilevers. It can be seen that from 10 cantilevers the bandwidth does not significantly increase. Therefore, the efficient number of cantilevers is 10 with a maximum bandwidth of 13 Hz.

The above observation can be made for various Δf . Fig. 7, a shows the dependence of the effective number of cantilevers on Δf . It can be seen that the further Δf is reduced, the more cantilevers may be used. A further interesting aspect is that, although the number of cantilevers is increased and Δf is reduced respectively (Fig. 7, b), the bandwidth does not exceed a value of about 15 Hz. This means that the mass tuning is limited and a wide frequency spectrum cannot be covered with mass tuning alone.

Fig. 8 shows the mechanical set up mounted onto the electrodynamic shaker (Bruel Kjaer 4826), driven by the power amplifier (Bruel Kjaer 2721). The signal for exciting the shaker is generated by the waveform generator (Rigol DG4062). The PEC array is mounted with the rigid metal frame onto the shaker, the clamping of the PECs is done accordingly to the specifications of Mide. The tuning is done by weights fixed on the tips of the PECs.

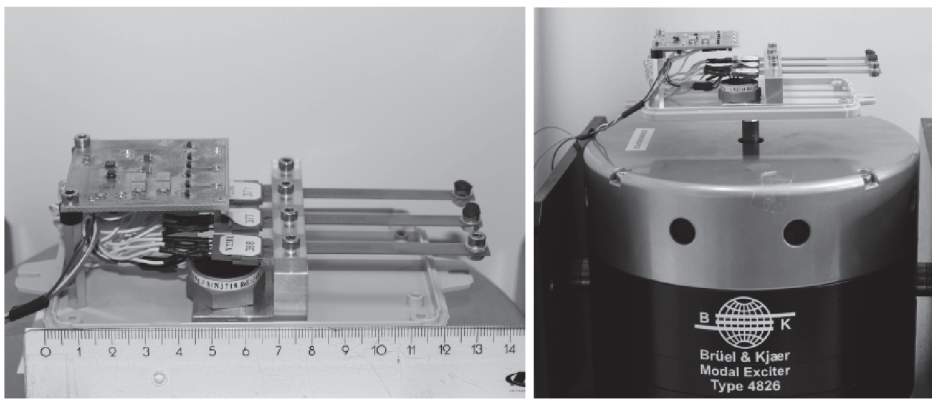


Fig. 8. Mechanical set up comprising PEC array.

This paper provides practical guidelines for optimum design of PEC beam arrays employed in the low-frequency vibration energy harvesting. The usable bandwidth can be extended by increasing the number of piezoelectric cantilevers distributed over the desired frequency band. Frequency tuning of a piezoelectric cantilever can be done either by changing the effective mass. But the mass tuning is limited and a wide frequency spectrum cannot be covered with mass tuning alone.

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