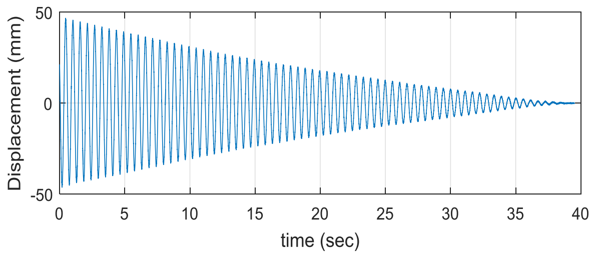

Fig. 7: Free vibration of the mass - Brush type 1

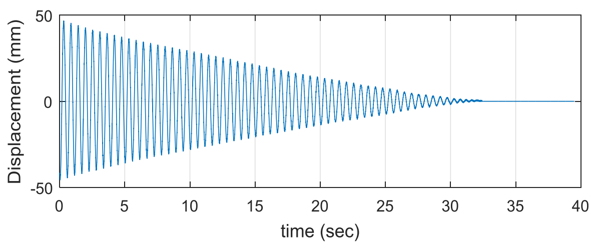

Fig. 8: Free vibration of the mass - Brush type 3

TABLE I: DAMPING RATIO ACCORDING TO HITTING-BRUSH TYPE

Brush Type	Damping ratio (%)
Type1	0.211
Type2	0.309
Type3	0.351

TABLE II: POWER GENERATION ACCORDING TO BRUSH-TYPE

Brush type	Maximum displacement (mm)	Maximum voltage (V)	Power (mW)
Type1	2.38	1.35	0.01
Type2	15.66	25.56	1.31
Type3	19.25	38.74	3.00

Table 2 arranges the maximum displacement, the maximum voltage and the amount of power of one piezoelectric element according to the type of brush. The power is calculated for a matching resistance of 500 kΩ.

As a matter of fact, the displacement at the tip of the piezoelectric element is seen to be larger with harder brush. As a result, the corresponding maximum voltage and power are also increased. Compared to type1, the voltage output of the TMPD using type3 is increased from 1.35 V to 38.74 V and the power is increased from 0.01 mW to 3.00 mW.

IV. CONCLUSION

In this paper, an experiment was conducted to improve the vibration control and power production capability of the Tuned Mass Piezo-Damper, a TMD in which the dampers are replaced by piezocomposite elements. The results showed that using brushes to hit or excite the piezoelectric element inside the TMPD was recommended to prevent damage of the element. Furthermore, the experiment conducted using three types of brush with different softness and thickness revealed that the use of a thin brush with rough bristles provided improved power generation and damping capacity. However, further studies should be conducted to ameliorate the damping capacity to a level comparable to the conventional TMD. Nevertheless, it is expected that more efficient power generation will be possible by using the relation that the thinner, the larger the strength, the more the displacement and the generated voltage output.

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J. Oh is born in Seoul, Korea, in 1995. She enrolled in the Civil Engineering Department at Hongik University in 2014 and obtained her BS in 2018 and enrolled the Graduate Program of the same department at Konkuk University in 2018