

Correlation analysis between magnetic, vibrational, and output properties in magnetic field assisted-vibration power generator

Mitsuru Ohtake (大竹 充)

Faculty of Engineering, Yokohama National University (横浜国立大学 大学院工学研究院)

Electromagnetic vibration power generation has attracted much attention as one of energy harvesting technologies, which enables the power supply for IoT devices. Inverse magnetostrictive type is known as a conventional method of vibration power generation. On the other hand, we have recently proposed a new method named magnetic field assisted type (Japanese patents, publication nos. 2023-174153 and 2025-177319), where a larger amount of magnetic flux can be varied and a higher output is thus obtained when compared with the case of inverse magnetostrictive type. Magnetic field assisted-vibration power generators primarily consist of a soft magnetic cantilever beam, a pair of magnets applying magnetic field to the beam, and a coil converting the variation of magnetization in beam to electric energy. In order to enhance the performance of magnetic field assisted-vibration power generator, it is necessary to understand its operation mechanism. In the present study, the influences of magnetic and vibrational properties of beam on the output characteristics were investigated. Lower magnetocrystalline anisotropy constant and higher saturation magnetic flux density were required to obtain higher output characteristics. Magnetic field generated by magnets not only assisted the magnetization reversal but also influenced the vibrational properties such as amplitude and resonant frequency, which also affected the output characteristics. Parts of the results obtained in the present study were published in Papers of Technical Meeting on Magnetism (vol. MAG-25-016, pp. 31–36, 2025) and IEICE Technical Report (vol. 125, no. 201, pp. 18–21, 2025) and presented at the 16th Joint MMM-Intermag Conference (AG-03), the IEEE Technical Meeting on Magnetism (MAG-25-016), the 7th International Conference of Asian Union of Magnetism Societies (23pPS-30), the 49th Annual Conference on Magnetism in Japan (16pPS-28, 17aPS-13, 17aPS-29, 19aC-2, 19aC-3, 19aC-4), the Technical Committee on Magnetic Recording and Information Storage (MRIS2025-9), and the FLE stage in EXPO 2025 Osaka.