Friction effect on output power delivered from a Fe-Ga rod based vibrational transducer equipped with a ferromagnetic yoke

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A vibrational transducer is able to transform mechanical input power into an electrical output. When the output power becomes significant, e.g. some milliwatts, the transducer can also act as an energy harvester, able to supply a load (e.g. a wireless sensor [1]). Fe-Ga alloy reaches good performances when operates in a close yoke structure [2] and provides better results than other giant magnetistrictive materials especially at low frequency [3]. To exploit properly the magnetization provided through permanent magnets and the yoke to the magnetistrictive rod, a very low air gap around the rod is required. Therefore, it is unavoidable that friction effect arises due to some contacts point between the yoke and the rod, when the mechanical vibration excite the latter. Such a friction affects the output power, as can be seen in Figure 1.

The aim of this paper is to analyse the friction effects on the output power and to propose an analytical approach to the problem.

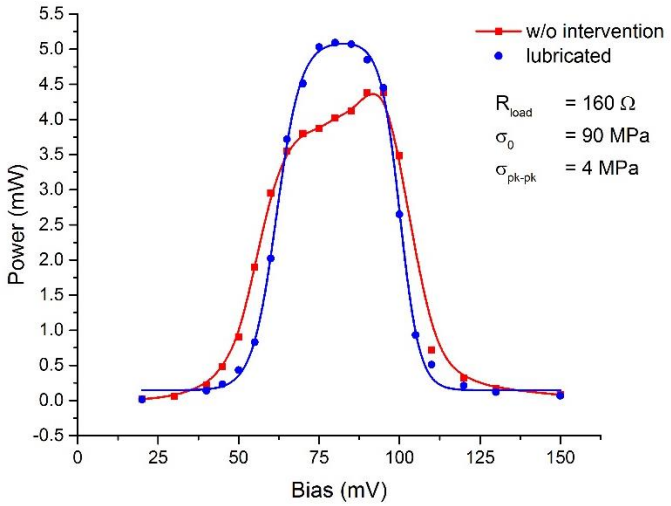

Figure 1. Friction effects on output power

[1] Lei Wang and F. G. Yuan, “Vibration energy harvesting by magnetostrictive material” Smart Materials and Structures, 17:045009, 2008.

[2] S. Palumbo, M. Zucca and O. Bottauscio, “Characterization of a Galfenol based vibrational energy harvester with a three-legged magnetizer” Submitted.

[3] V. Berbyuk, “Vibration energy harvesting using galfenol-based transducer” Active and Passive Smart Structures and Integrated Systems. SPIE, vol. 8688, pp. 17-22, Apr. 2013.