

Master's/Bachelor's Project:

Manufacture and characterization of 3D active rotating particles, *VIBROTS*

Introduciton:

A **VIBROT**, as the one shown in Fig. 1, is a device capable to convert vibrational energy into rotational energy by means of friction, [1]. Modern manufacturing techniques, such as rapid prototyping using 3D printers, enable us to fabricate more accurate and complex versions of this device, see Fig. 2. The dynamic properties of each vibrot depend on its mass, shape, material, fabrication method, that is why characterization experiments play a key roll after the manufacture process.

Project:

The first part of the project is intended to the design and manufacture of different kind of vibrots, using 3D printers. The parameters to be changed will be mass, length of the legs, inclination of the legs and finally the overall shape of the vibrot (up to your imagination).

The second part of the project is intended to the investigation of the dynamic properties of the manufactured vibrots. Each particle will be placed on a vibrating platform and its whole motion will be recorded with a high speed camera. Further, by applying image processing methods each particle will be tracked and its dynamic properties, such as linear and angular velocity, mean squared displacement, etc., will be determined.

The last part of the project is intended to the optimization of the designed vibrots in order to reveal desired behaviours.

What you will learn:

Modelling and printing in 3D. High speed movie recording techniques. Image processing.

Contact information:

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References

- [1] Altshuler, E., Pastor, J. M., Garcimartín, A., Zuriguel, I., & Maza, D. (2013). Vibrot, a simple device for the conversion of vibration into rotation mediated by friction: preliminary evaluation. *PloS one*, 8(8), e67838.
- [2] Scholz, C., & Pöschel, T. (2016). Actively rotating granular particles manufactured by rapid prototyping. *Revista Cubana de Física*, 33(1), 37-38.
- [3] Torres, H., Freixas, V. M., & Pérez, D. (2016). The Newtonian mechanics of a Vibrot. *Revista Cubana de Física*, 33(1), 39-43.

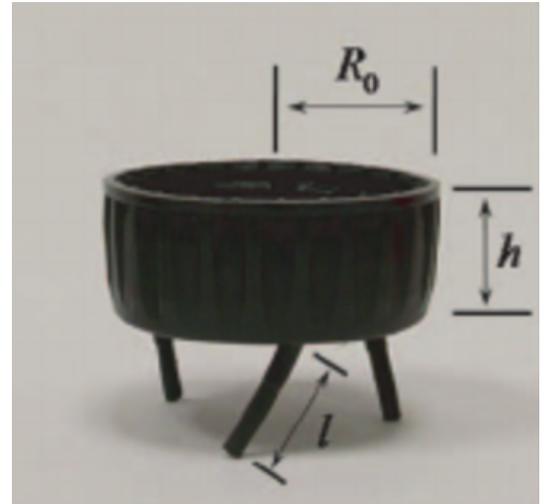


Figure 1: Original figure in [1]

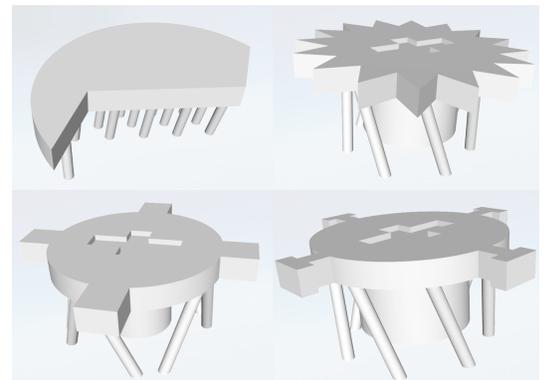


Figure 2: 3D models of vibrots