Chladni patterns on an elastic membrane

Research Internship M2 (2020-2021)

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Research project :

When sand is sprinkled on a vibrated plate, it accumulates near the vibration nodes of the plate forming the famous "Chladni patterns" (Fig. 1, [1]). These patterns, which vary with the forcing frequency, provide an easy visualization of a musical instrument when it needs to be tuned, for example. However, if the plate is soft enough, as an elastic membrane, grains can deform it and change in turn the modes' pattern and frequency.

To investigate this coupling, we focused on a 1D-version of the system, where a bead is bouncing on a narrow elastic ribbon. In this configuration, new modes arise: for example, the ribbon can twist to stabilize the bead at precise frequencies (Fig. 1(d) and 1(e)). Now, the goal is to set up the two-dimensional experiment and to develop techniques to visualize the membrane motion or to track grain trajectories. Doing this, we hope to model the interaction between heavy particles and a vibrated membrane.

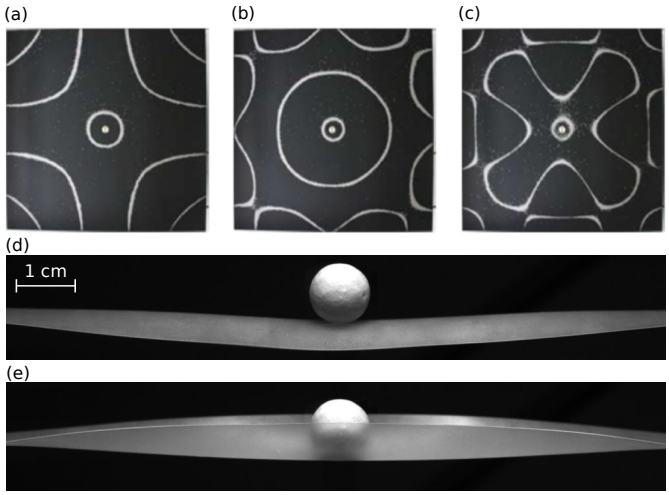

Figure 1: Chladni pattern on an aluminum plate [2]. (a) f = 630 Hz (b) f = 1023 Hz (c) 1240 Hz. (d) & (e) : Bead bouncing on a vibrated ribbon.

[1] M. Faraday, Philos. Trans. Roy. Soc. London 52, 299 (1831)
[2] Tuan, P. H., et al. The Journal of the Acoustical Society of America (2015)