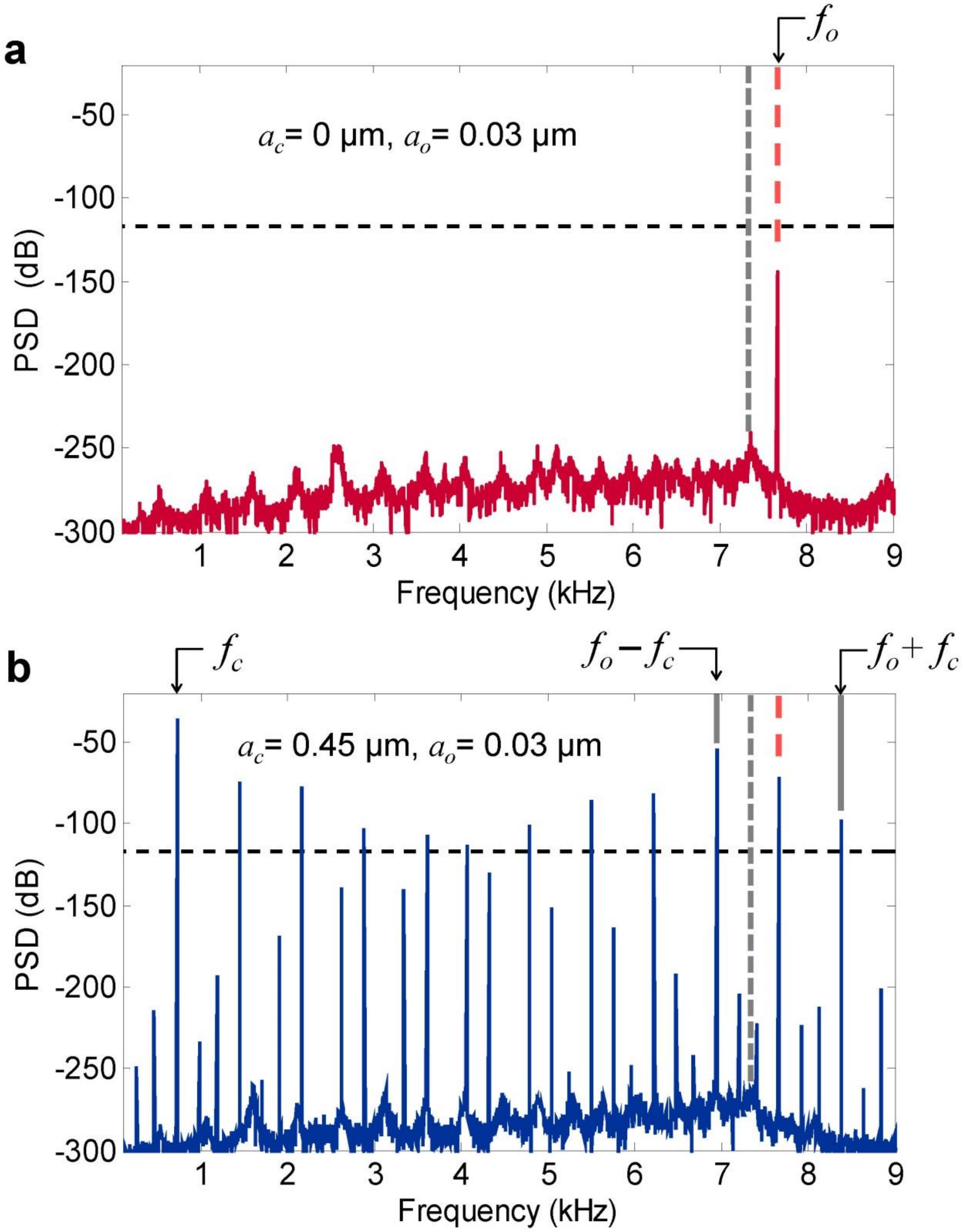
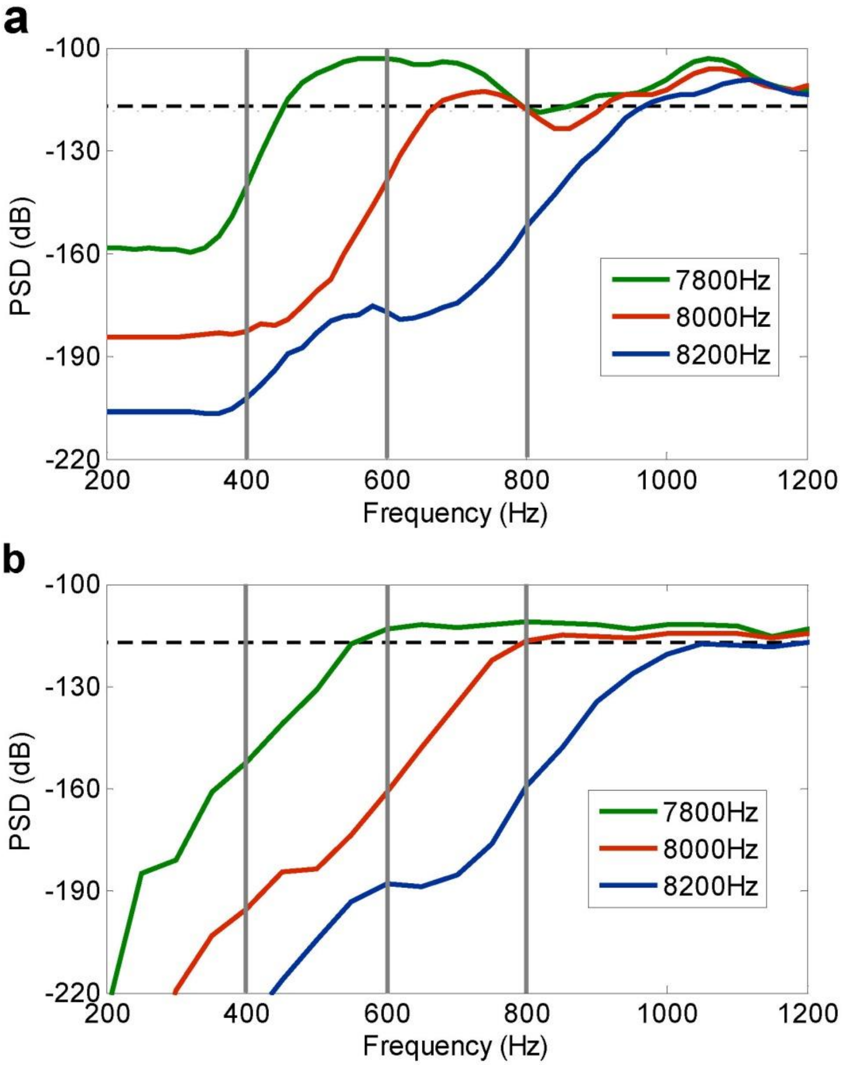
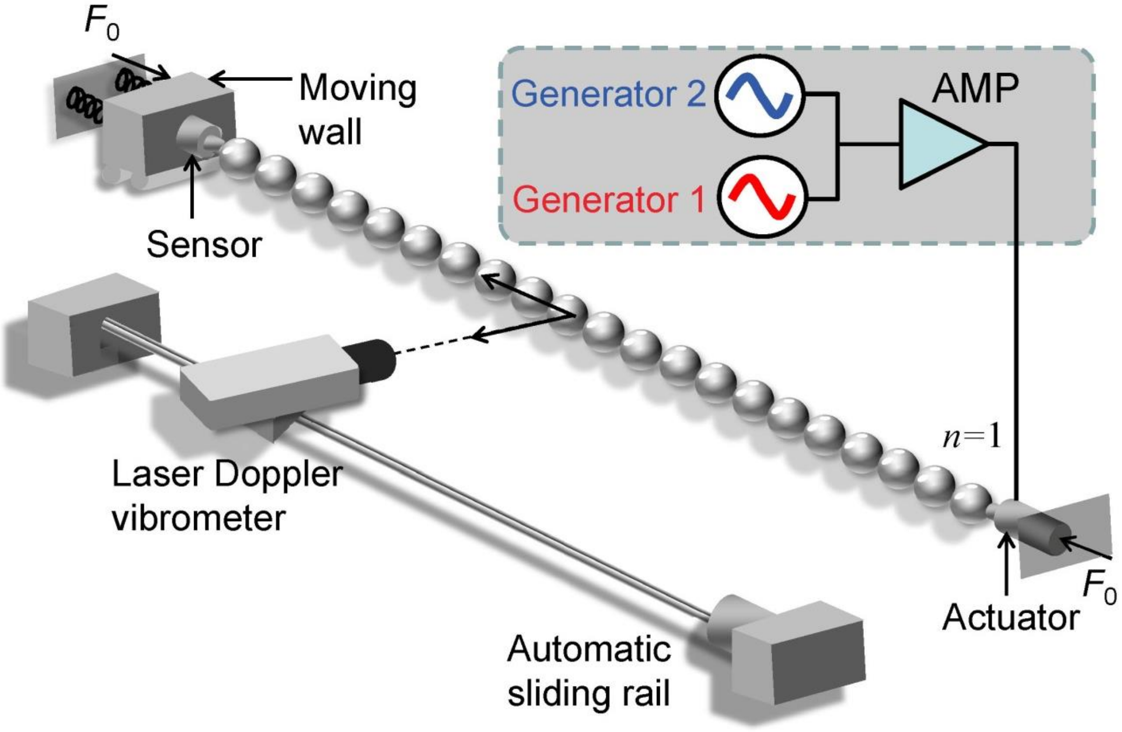


Supplementary Figure 1: **| Simulation data. (a)** Switch-*off* configuration: The acoustic wave at f_o (7660 Hz) is –144dB, which is lower than the noise floor of the spectrum analyzer. **(b)** Switch-*on* configuration: When another high-amplitude acoustic wave with a_c = 0.45 µm and f_c = 720 Hz is added, the power of f_o is raised to –71dB.



Supplementary Figure 2: **| Simulation data of power transmission. (a)** The relative dynamic deformation is reduced to $\delta_m/\delta_0 = 0.08$ for a 21-particle chain. **(b)** The number of particles in the chain is increased to 50, while we keep $\delta_m/\delta_0 = 0.08$.



Supplementary Figure 3: | **Experimental setup.** A schematic of the experimental setup composed of a 1D granular chain and the Laser Doppler Vibrometry system.

Supplementary Note 1: **Numerical simulation data of switch OFF/ON.**

In the simulation corresponding to the switch-*off* configuration, we use the parameters for excitation a_o = 0.03 µm, f_o = 7660 Hz. The simulation results are shown in Supplementary Fig. 1a. The vertical gray line corresponds to the theoretical cutoff frequency, and the noise level of the experimental measurement is denoted by the horizontal black dashed line as a reference. We can see the transmission gain under the *off* status is between –300 dB and –250 dB except for the frequency at f_o (7660 Hz). The PSD of acoustic wave at f_o is –144 dB, which is 27 dB lower than the noise level of the spectrum analyzer. Under the switch-*on* configuration, we add a high-amplitude control signal with a_c = 0.45 µm and f_c = 720 Hz. In this case, the transmission gain at

f_o increases to –71 dB, which is 73 dB and 46 dB higher than the switch-*off* status and the noise level respectively. The simulation results are in approximate agreement with experiments.

Supplementary Note 2: **Power transmission through a longer granular chain with lower dynamic deformation**

When the ratio δ_m/δ_0 decreases, the nonlinearity effect of the chain becomes weaker as demonstrated in Supplementary Fig. 2b. As a result, the PSD of the harmonic decreases drastically, especially for the acoustic waves whose frequencies lie farther away from the output frequency f_o (i.e., the acoustic wave at $f_o - 2f_c$ decreases faster than that of $f_o - f_c$). Thus, when the relative dynamic deformation is small, the contribution of $f_o - 2f_c$ and $2f_c$ to f_o became less evident. This implies that we can obtain clearer vertical “cliff” response under smaller dynamic disturbances, exhibiting an evident switching response. To verify this, we conduct numerical simulations using weak amplitude of relative dynamic deformation ($\delta_m/\delta_0 = 0.08$) at the boundary and the same amplitude of a_o (0.06 μm) with experiments. The results are shown in Figure S2a, where the vertical lines (400Hz, 600Hz, 800Hz) represent the threshold frequencies f_T for the output frequencies f_o (7800Hz, 8000Hz, 8200Hz). We observe that the PSD curves show less fluctuations below the threshold frequencies f_T and show smooth transitions from *off* to *on* status (c.f., Figure 3c). Due to the small excitations, however, we find that the transmission gains of the system are near the noise floor of the experimental measurement (black dashed horizontal line). We conduct additional numerical simulations to observe the effect of a longer granular chain (Supplementary Fig. 2b). We increased the number of chain to 50 particles, while keeping the magnitude of dynamic disturbances the same ($\delta_m/\delta_0 = 0.08$). As a result, we observe a significant reduction of PSD fluctuations, particularly above the threshold frequencies f_T. In practical cases, however, these results are difficult to discern experimentally, because the amplitudes are near the noise floor of our instrument and smaller than the acoustic leakage.