PROCEEDINGS of ISMA 2019
International Symposium on Music Acoustics

13 - 17 September 2019 in Detmold, Germany

A liquid sloshing vibrato mechanism for the Symbaline; an active wine glass instrument *†‡

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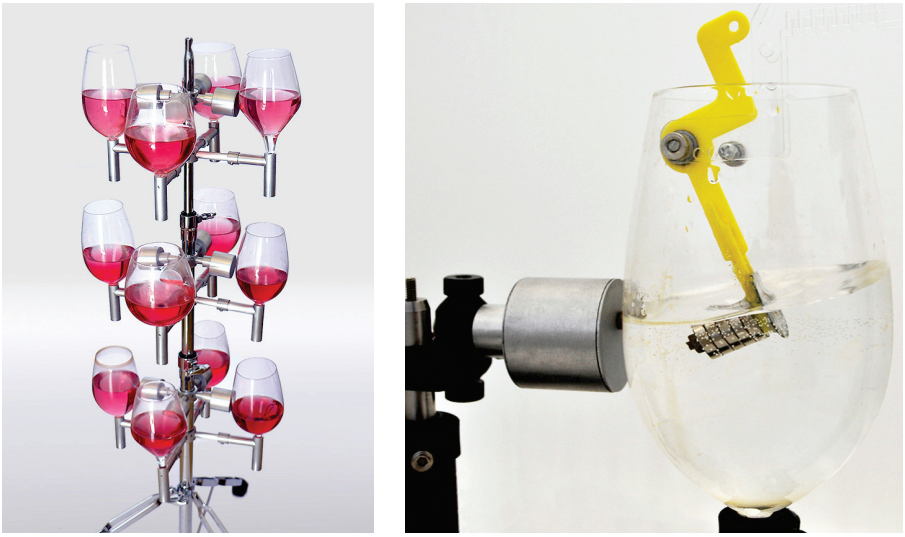
Abstract

The Symbaline is an active instrument consisting of water tuned wine glasses excited by electromagnets. Its timbre is characterized by steady overtones and a smooth attack-decay envelope. In this demonstration we present an electromechanical system for adding vibrato to the Symbaline's sound. The system consists of a pendulum with a magnetic bob, submerged inside the liquid in the wine glass. Infra-sound signals are sent to an electromagnet external to the glass, generating a magnetic field which puts the pendulum into oscillation. As a result of the pendulum's movement the liquid in the glass sloshes and the water level fluctuates in a periodic manner. Audio frequency signals are sent to the same electromagnet, in parallel, inducing vibrations in the wine glass itself, by exciting a small magnet on the glass's surface. While the glass is radiating sound, its resonance frequencies are altered by the changing water levels, resulting in frequency and intensity modulation.
Keywords: Active, Liquid, Vibrato, Electromechanic, Wineglass



(a) (b)

Figure 1. (a) The Symbaline, consisting of a set of tuned wine glass actuated by electromagnets. The Symbaline is played by an amplified auxiliary musical instrument (not shown). (b) The vibrato mechanism in mid oscillation. The pendulum is excited to oscillation by the electromagnet placed outside the glass. The water is sloshing, periodically altering the glass resonance frequencies and modulating the wine glass tone.

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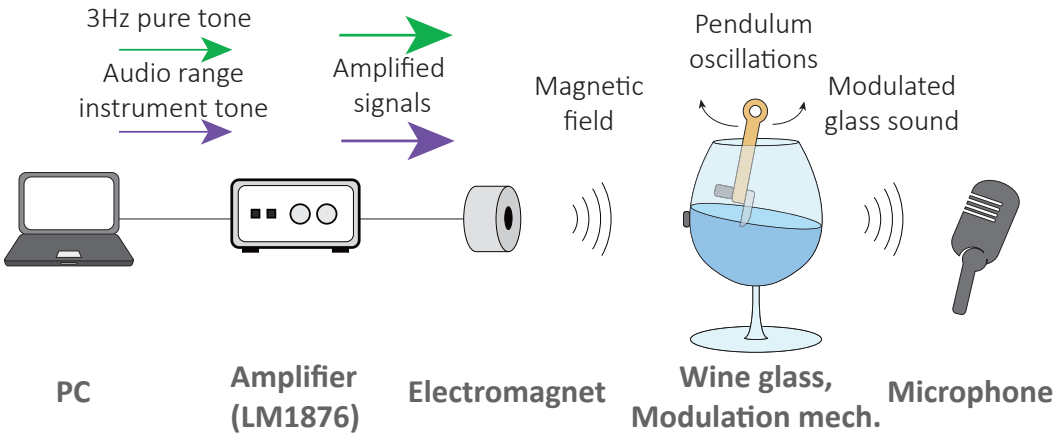

Figure 2. Block diagram of the modulation mechanism setup. The PC generates both a low-frequency tone and an audio range tone sampled from a musical instrument. The signals are amplified and routed to the electromagnet, where they are converted to a magnetic field. The audio range signal excites wine glass tones, and the low-frequency signal oscillates the pendulum. The pendulum oscillations generate water sloshing which modulates the wine glass radiated sounds.

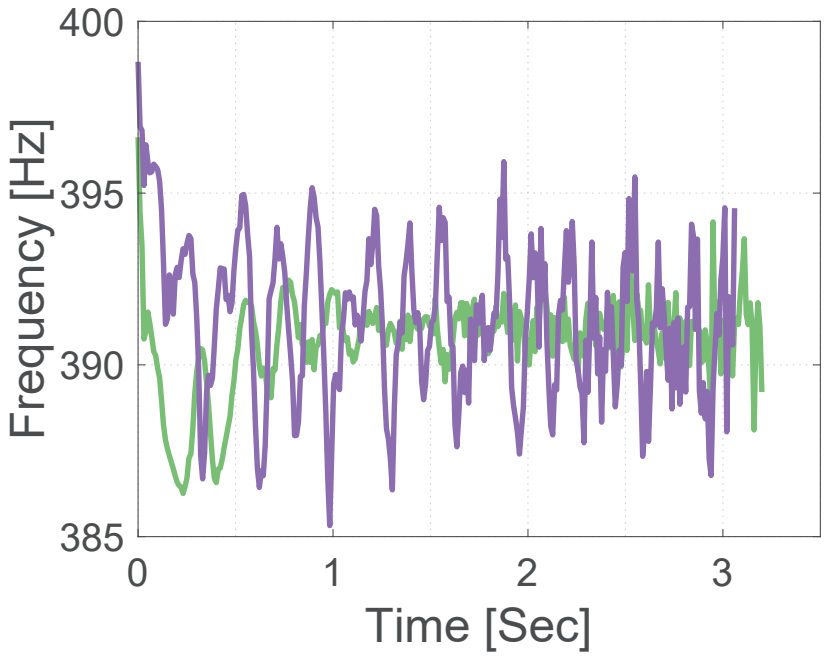

Figure 3. Analysis of the fundamental frequency of a wine glass tone excited by a classical guitar signal. The wine glass tone is modulated by activating the pendulum. A plot of the resulting wine glass fundamental frequency over time is shown in *purple*. The fundamental frequency of the non-modulated tone is shown in *green* for comparison.