

METHODS FOR EXCITING WINE GLASSES BY COUPLING TO PLUCKED STRINGS - THEORY AND EXPERIMENT

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ABSTRACT

Wine glasses can be used to produce musical sounds, either as standalone makeshift instruments or as components of carefully tuned instruments such as the Glass Harp. Typically, wine glasses are played either by rubbing a moistened finger around the rim, or by using a mallet or a bow. The glasses are tuned to specific pitches and each glass is used for producing a single note. The current study proposes a new method for exciting wine glasses, using a concept similar to that of sympathetic strings, found in such instruments as the Sitar. While the Sitar uses sympathetic resonance between sets of coupled strings, this research explores the idea of using sympathetic resonance between strings and wine glasses, where the vibration of the string produces vibration in the glass. Two methods for creating string-glass coupling were explored: 1) by direct contact; 2) by using an intermediate component similar to a string instrument's bridge. The coupling component was developed by a process of topology optimization using FEM simulations, resulting in a small cane-shaped design. Experiments tested the responses of three wine glasses having different frequency responses to excitation by pitched strings using both methods. The findings show that both methods produce audible responses from the glasses, with the direct string-glass contact method having the loudest responses. Each glass responded to several different pitches, with each response having a different spectrum. The methods developed in this research offer a new approach to the design of wine glass based instruments. Instruments designed with this approach can have a small number of glasses, each producing different notes without being directly excited by the player. The use of the coupling component allows for greater flexibility in the placement of both glasses and strings.