PROCEEDINGS of ISMA 2019
International Symposium on Music Acoustics

13 - 17 September 2019 in Detmold, Germany

Experimental setup for real-time control of a single-reed woodwind instrument model

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Abstract

This paper demonstrates an experimental setup for music acoustic experiments and contemporary music performance following a hybrid physical modelling approach. In this setup, a clarinet mouthpiece with a sensor-equipped reed is coupled to a virtual tube [1]. A C++ implementation of a tube model is presented in the form of a Csound opcode which runs on the ultra low-latency audio platform Bela [2]. The coupling is realised with an actuator that acts on the sensor-reed. The actuator is driven by the virtual pressure at the closed end of the tube model, whereas the sensor-reed signal is fed back to the model as volume flow. The experimenter can modify the parameters for length, radius, conicity, end-reflection and air density of the tube model, and is also given control over the coupling between reed and actuator in real time. This setup allows to explore acoustic phenomena that are usually either enclosed (reed-resonator coupling) or static (e.g. resonator shape) in conventional acoustic instruments and may also be useful for music acoustics training.

Keywords: Physical Modelling, Woodwinds, Realtime Audio, Haptic feedback, Bela, Csound

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