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Experimental study on the temporal fluctuation of harmonics in flute sounds

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Abstract

There are some studies on the temporal fluctuation of harmonics in flute sounds. However, it is still unclear whether it is due to the fluctuation coming from human player or the nature of the sounding mechanism. In this study, an experiment was conducted to investigate temporal fluctuations purely due to the sounding mechanism of the flute. For this purpose, an artificial blowing system was built in order to yield flute sounds by a constant air flow as well as by adjusting the angle, offset, length and velocity of the jet. The temporal fluctuation for a harmonic component was computed by a standard deviation for a series of instantaneous harmonic amplitudes obtained from a short-time audio analysis. The result shows that the temporal fluctuation increases as the average harmonic amplitude decreases, and vice versa. The effect of the temporal fluctuation on perceptual impression was finally confirmed by a synthesis experiment where flute sounds were re-synthesized with controlling the amount of the temporal fluctuation.

Keywords: flute, fluctuation, artificial blowing

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