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Numerical synthesis applied to reed instruments: influence of the control parameter transients on the steady-state oscillation regime

Tom Colinot[a], Philippe Guillemain[b], Jean-Baptiste Doc[c] and Christophe Vergez[b]
[a]LMA Marseille
[b]LMA
[c]LMSSC, CNAM
colinot@lma.cnrs-mrs.fr

Physical models of self-oscillating musical instruments include strongly nonlinear elements and delayed terms, leading to a great variety of produced sounds. For example, the same fingering on a wind instrument can produce oscillating regimes at several different fundamental frequencies as well as quasi-periodic regimes. The emergence of these regimes is conditioned mostly by the value of control parameters, representing the action of the musician, such as blowing pressure or lip force on the reed. As a strongly non-linear delayed system, a wind instrument model may converge to different stable regimes depending on the initial conditions and the transient of the control parameters. For the second point, an example would be the speed with which the blowing pressure reaches its final value. In this work, we show that depending on the way the blowing pressure increases to its final value, the steady regime may be oscillating or non oscillating, or correspond to the first or second register. Such considerations are useful when trying to predict the playability of an instrument using numerical simulations.

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