

ACOUSTICS2008/2698 Modeling and automatic control of a slide flute

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In this paper, we consider the problem of modeling and control of a slide flute: a kind of recorder without finger holes but which is ended by a piston mechanism to modify the length of the resonator. A previous study has been done, but with a very simple boundary condition for the mouth, corresponding to an ideal situation assuming that the acoustic pressure is zero at the entrance of the resonator.

In this work, we have taken into account a more realistic model, describing the coupling effects between the jet and the pipe. The jet is obtained by blowing through a flue channel and formed by flow separation at the flue exit, and finally directed towards a sharp edge, called the labium. The resulting structure will be described by two linear PDEs coupled with nonlinear ODEs describing the boundary conditions: for the mouth, taking into account the jet dynamics, and for the piston.

A modal analysis is performed using the linearized boundary conditions which can also be used to compute the suitable blowing pressure and the suitable pipe length to obtain a desired fundamental frequency or equivalently a desired pitch. This will constitute the basis of our control algorithm.