PERIODIC AND QUASI-PERIODIC REGIMES OF AN ALTO SAXOPHONE ACCORDING TO THE CONTROL PARAMETERS AND THE BORE INHARMONICITY

Jean-Baptiste Doc, Christophe Vergez

Laboratoire de Mécanique et d'Acoustique, France
jbdoc@lma.cnrs-mrs.fr
vergez@lma.cnrs-mrs.fr

ABSTRACT

The aim of this work is to highlight experimentally how inharmonicity of the bore res- onance frequencies of an alto saxophone influence the nature of the oscillation regimes. A variable volume branching from the neck of an alto sax at an appropriate position allows to change the frequency of the first resonance independently from the second. A blowing machine with artificial lips is used to make the saxophone play while controlling independently the control parameters: the blowing pressure and an embouchure parameter. Values of these parameters are estimated experimentally through the measurement of the nonlinear characteristics linking the mean air flow blown into the instrument to the static pressure difference across the reed. Experiments with different values of the control parameters as well as of the inharmonicity produce different kinds of oscillation regimes. These regimes are categorized through the analysis of the pressure signal inside the mouthpiece. The resulting maps demonstrate that the emergence of quasi-periodic regimes, and their extent, depend on the level of inharmonicity, but also on the values of the control parameters. Periodic regimes playable by choosing appropriate values of the control parameters also differ according to the level of inharmonicity, a higher inharmonicity facilitating the emergence of the third register. Trends highlighted experimentally in this article are in agreement with numerical results obtained in a previous work. This numerical study was based on the use of a minimal model of wind instruments, so it is possible to deduce that features neglected in this model are not determining in the production of quasi-periodic regimes (inertia and damping of the reed, resonance modes higher than the third one)