PROCEEDINGS of ISMA 2019
International Symposium on Music Acoustics

13 - 17 September 2019 in Detmold, Germany

Simulation of the nonlinear characteristic of the clarinet exciter and of the side holes *†

Pierre-André TAILLARD[(1)], Jean-Pierre DALMONT[(2)]

[(1)]FHNW, Schola Cantorum Basiliensis, Leonhardsstrasse 6, 4051 Basel, Switzerland

[(2)]Laboratoire d'Acoustique de l'Université du Maine (UMR CNRS 6613), 72085 Le Mans, France

Abstract

At the last ISMA, a method for measuring the nonlinear characteristic and the static mechanical behaviour of the clarinet exciter (reed + mouthpiece + lip of the player) was presented. Here, we show how this measured behaviour can be integrated in a real time simulation using a waveguide clarinet model, including nonlinear losses at the toneholes. The clear separation of the aeraulic (nonlinear characteristic) and mechanical (static bending of the reed against the mouthpiece lay, like a stiffening spring) aspects allows a straightforward, piecewise simulation of the dynamic behaviour, apparently without any numerical stability problem. Taking nonlinear losses in the toneholes into account has proved crucial for a credible simulation of the instrument, especially in the second regime. The model allows to realistically predict the playing frequency, the ease of playing and the timbre of the instrument. An example is given for the simulation of the effect of the two main objective factors characterizing clarinet reeds: stiffness and opening at rest (without lip pressure). The proposed improvements allow a virtual prototyping of the clarinet exciter and resonator.

Keywords: Wind instruments, clarinet, reed characterization, sound synthesis by physical model, waveguides

1 INTRODUCTION

Interested readers will find an extended description of the methods used in Chapters 4, 5 and 7 as well as in Appendices A and B of [1].

ACKNOWLEDGEMENTS

We thank the engineering school HE-Arc (Neuchâtel, Switzerland) for the facilities granted.

REFERENCES

[1] Taillard, P.-A. Theoretical and experimental study of the role of the reed in clarinet playing. PhD thesis, University of Le Mans, France, 2018.

*taillard@hispeed.ch
†Jean-Pierre.Dalmont@univ-lemans.fr