On the Second Register’s Playability of the Clarinet: Towards a Multicriteria Approach

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ABSTRACT

During the centuries of the clarinet evolution process, woodwind makers had to empirically understand how to choose a design that allows a good control of its musical attributes. The most important ones can be defined as, intonation, ease of playing and tone color. A preliminary study focuses on the efficiency of a gradient based optimization algorithm to consider the intonation criterion. Promising results were obtained by using the first two resonance frequencies of the input impedance resulting from the geometry being optimized. It also shows the need of introducing a second criterion dedicated to the ease of playing for the second register, as the reactive attenuation of the first impedance peak can’t be controlled by only the targeted resonance frequencies. Indeed, in this preliminary study, the first impedance peak remained higher than the second one which prevents register change. This article presentation will propose different objective definitions of the required ratios between first and second impedance peaks. Then a multicriteria optimization algorithms (goal attainment method) is applied to take advantage of each, intonation and second register playability criteria. Two prototypes were realized and results were validated by musicians and impedance measurements. They confirm the diversity of a register hole functionalities. A dual propensity to balance inter-register inharmonicity and second register playability can be counterproductive and demonstrate the real benefit of increasing and dedicating register holes, which is not the case on the current Boehm clarinet.