Material and obsolescence on flute quality

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Abstract: The effect of material and obsolescence on flute sound quality has been analyzed on two Boehm flutes. Ranging from the experiment of Coltman (1), in which different instruments were compared by musicians, the study has been carried on by measuring impulse responses inside the tube, in different positions, through a new developed system (3). From the IRs, comparisons of different measurements in different positions have been developed, and the bases to calculate the new developed acoustical energetic parameters have been acquired (2,4).

THE FLUTES

The influence of material and obsolescence in sound quality on flutes is well known among musicians. It is well known that a "gold flute" *sounds* better than a "alloy flute", thought it is not well established where the difference lies. In this paper a set of acoustical measurements have been made by using of a microphone inside the flute, and a loudspeaker positioned on the mouthpiece. The sound source was fed by the MLS produced by a sound board mounted in a PC, and the IRs were calculated from a newly developed software available at University of Parma namely Aurora (3).
Two different flutes were analyzed, namely a Bundy (a nickel silver and copper alloy), and a Muramatsu (silver metal only). The first one was an obsolete instrument, while the second a quite new flute.

FIGURE 1 the set-up for the measurements

ACOUSTICAL MEASUREMENTS

In order to define the acoustic properties of the material and to make also a virtual reconstruction of the instruments, the IRs have been measured in few positions. From the measurements, the TFs were calculated, and compared each other. From the IRs the newly defined energetic parameters (2) could be calculated in the next future.
The measurements of IRs showed the differences in time domain between the two flutes, being the first one (Bundy) slightly more "reverberant" that the second one (Muramatsu).
In the frequency domain, the IRs of the two flutes were characterized by a different component at high frequency, where the silver flute had slightly more partials than the other one (Bundy). Such different is remarkable, and clearly audible by listening to the different IRs. It was also noted that not significant differences were found, either in time domain or in frequency domain, by changing the position of the microphone.

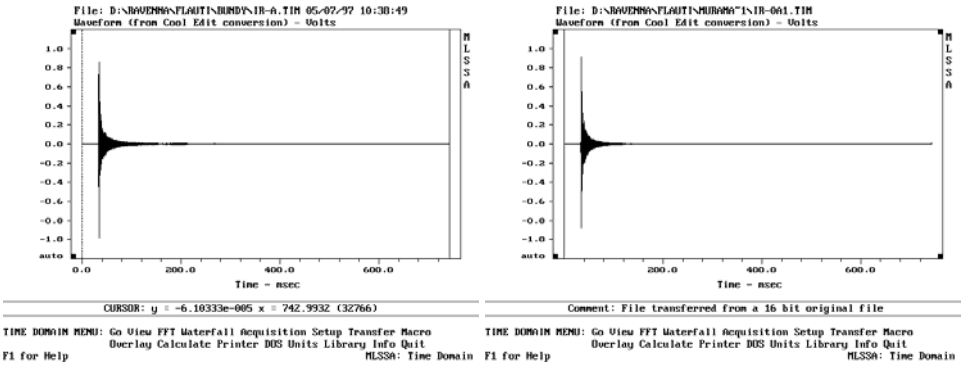

FIGURE 2 the IRs: flute "Bundy" (left) and Muramatsu (right)

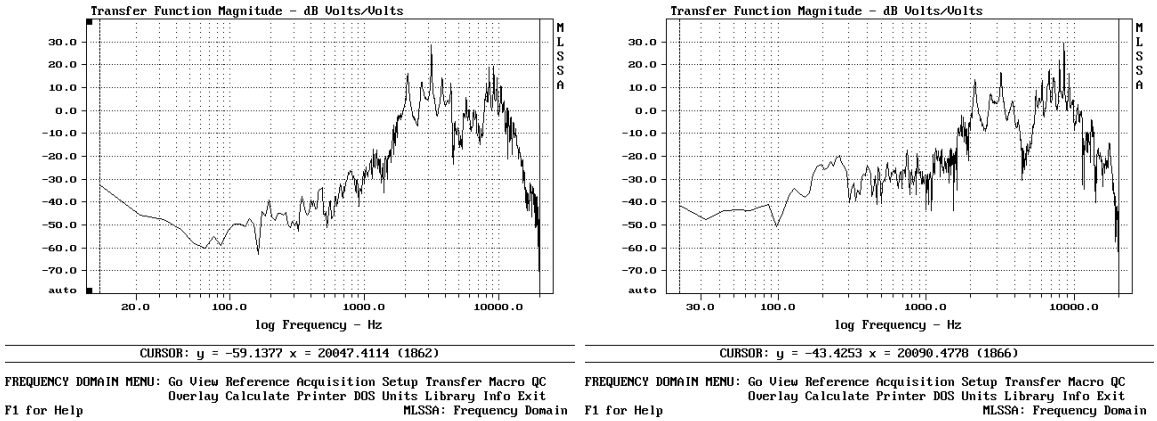

FIGURE 3 the TFs: flute "Bundy" (left) and Muramatsu (right)

This underlined the requirements to make energetic evaluations by calculating of the newly parameters defined in (2) and already measured recently in (4).

CONCLUSIONS

From an acoustical point of view a remarkable difference between the two flutes on tone quality have been found, either in time or in frequency domain. No significantly differences by changing positions of the microphone were found, but the measurements already performed allow to calculate other parameters more related to the energetic properties of sound tubes (4).

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REFERENCES

1. Coltman, J.W., *Journal of Acoustical Society of America*, 49(2), 520-523 (1971)
2. Stanzial, D., Prodi, N., Schiffrer, G., *Journal of Acoustical Society of America*, 99(4), 1868-1876 (1996)
3. Farina, A., Auralization software for the evaluation of a pyramid tracing code: results of subjective listening tests" - ICA95 (International Conference on Acoustics), Trondheim (Norway) 26-30 June 1995.
4. Stanzial, D., Bonsi, D., Prodi, N., "Measurement of Newly Defined Energetic Indicators of the Steady Sound Field inside an Organ Pipe", *Proceedings of ISMA97*, Edinburgh, UK, 1997