

## **Reed Chamber Resonances and Reed Tongue Vibrational Modes in Free Reed Excitation**

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### **ABSTRACT**

Recent studies of the initial transients in Western free reed instruments such as the accordion, harmonica, and harmonium, have concentrated in two areas. The first of these is the significance of higher transverse and torsional modes in initiating reed tongue vibration. The second regards effects of the reed chamber resonances. The motion of the reed tongue in early stages of the initial transient has been studied in some detail using reeds from a reed organ. Oscillation waveforms were obtained using a laser vibrometer system, variable impedance transducer proximity sensors, and high speed video with tracking software. Spectra derived from the vibrational waveforms in each stage have been analyzed, showing that the second transverse mode and the first torsional mode are both observed in the transient, and that the torsional mode appears to be especially significant in the earlier stages of oscillation. Comparison of reed tongues of different design have shown that curving the reed tongue to enhance the role of the torsional mode in the initial excitation may somewhat alleviate the problem of slow speech that typically affects larger, lower-pitched reeds. Although reed chamber resonances can affect tone quality and may have some effect on pitch, the cavity volumes are small and the chamber resonances have high frequencies, so that effects on reed excitation usually tend to be small. However, for higher pitched reeds in the accordion or harmonica, a resonance of the reed chamber can be close to the vibration frequency of the reed tongue. In this case the cavity air vibration can interfere with tongue vibration, inhibiting or possibly preventing the sounding of the reed. Recent experiments have verified that reed chamber resonances can indeed have this effect. Builders typically attempt to alleviate this situation by modification of the reed chamber. In the harmonica, skilled players may be able to overcome this difficulty by appropriate changes in vocal tract resonances.