EXPERIMENTAL STUDY OF THE SOUND PRODUCED FROM A CONCERT ACCORDION

Maria Jesus Elejalde Garcia, Erica Macho Stadler, Ricardo Llanos Vazquez, Asier Agos Esparza
University of the Basque Country, Spain
mariajesus.elejalde@ehu.eus
erica.macho@ehu.eus
ricardollanosvazquez@gmail.com
asieragos@gmail.com

ABSTRACT

Western free-reed musical instruments include various families: accordions, concertinas, reed organs and mouth organs. In the accordion, each free reed is riveted on a metal plate, named “reed plate”. The reed plate is normally made of aluminium and the reed tongue is a piece of steel. The non-riveted end of the reed is free to vibrate from one side to the other of a slot carved on the reed plate under the reed. These boundary conditions are similar to those of a cantilever beam. An accordion reed is only activated when air driven by the bellows comes from the same side of the plate on which the reed is riveted (inward-striking reed or inward-sliding reed). As it has little damping, the reed vibrates with a frequency just below the lowest resonance frequency of the clamped-free bar. Apart from this, due to the non linearity of the problem, a great number of harmonics are found for that frequency instead of the non-harmonic overtones expected for a clamped-free bar. On the reverse of the reed plate there is another identical reed with its corresponding slot. One of the reeds sounds when opening the bellows and the other reed sounds when closing the bellows. In the case of medium or large reeds, the opposite side of the slot is completely covered by a strip made of leather or plastic that moderates the airflow and avoids the passage of air through the hole in the reed tongue that it is not activated. Bigger reeds produce lower notes. A small mass is placed on the tips (free end) of the accordion's lowest reeds to attain low frequencies without being too long. Accordion reeds are usually tuned by removing material at the free end (to raise the pitch) or removing it in the middle (to lower the pitch). Reed tongues must be carefully contoured: a sharp change of section should be avoided as this is liable to cause a “stress raiser” which can result in a fracture forming. Accordion players distinguish between bellows attacks and finger attacks. In bellows attacks the button (or key) is pressed first and the bellows are moved after. In finger attacks, the bellows are set in motion (by pulling or squeezing them) and soon afterward the button is pressed down. In this work, we present the relationships between the control of a concert accordion, the generated sounds, and how these are perceived are analysed. We explore the mass load effect on sound timbre and the fine differences in timbre for bellows attack and finger attack.