

String / Fretboard Interaction in Electric Basses: Simulations and Experiments

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ABSTRACT

The non-linear behaviour of string instruments, either intended or not, is decisive for instrument making and playing techniques. In particular, collisions between a string and an obstacle arise in numerous musical instruments, among which tanpuras, sitars, electric basses, etc. In the case of electric basses, contact occurs for specific playing techniques such as pop or slap, for which the musician plucks or hits a string strongly enough to make a string / fretboard interaction appear. In the present study, this non-linear vibratory behaviour is both simulated and measured for an electric bass. The numerical model is based on a modal description together with a regularised contact force, and was recently developed and applied to the contact between a vibrating string and a point obstacle [1]. The scheme is conservative and includes a weak coupling between the string and the structure. Besides, highly controlled experiments are led on an electric bass in order to compare numerical and experimental data. A good agreement between numerical simulations and experiments is found. In particular, specificities of the resulting sounds are faithfully reproduced. Finally, the influence of numerical and physical parameters, possibly related to tuning issues, is exhibited through a numerical parametric study.

[1] C. Issanchou, S. Bilbao, J.-L. Le Carrou, C. Touzé, and O. Doaré, A modal-based approach for the non linear vibration of strings against a unilateral obstacle: simulations and experiments in the pointless case, *Journal of Sound and Vibration*, 393, pp. 229-251 (2017).