



Analysis of the attack phase of a guitar sound using high speed digital holography

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In the transient phase of a guitar sound, the spectral components associated with the string modes are superimposed to the contributions due to the structural modes of soundbox. Such contributions are strongly damped and allow us to define the attack phase, which is likely to play an important role in the perception of the instrument. In this paper, we propose to study the vibration of a guitar soundboard during the attack phase using high speed digital holography : Optical holography is a non-intrusive technique based on the interference between a reference beam and the field diffracted by the studied object . The computation of the optical phase difference provides the out of plane vibration field with a very high spatial resolution. The recording of a sequence of holograms is performed using a high-speed camera, which permits to get a high resolution in the time domain. The noise present on the displacement field reconstructed at each time step depends on many parameters. A full numerical simulation of the measurement set up allows us to analyze and minimize this measurement noise. For the experiment presented in the paper, the excitation of the string is done using a wire-breaking technique in order to control precisely the string polarization at the beginning of the motion. The analysis of the motion is performed using a projection over the soundboard modes, and leads to a discussion on the structure of the attack phase.