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Investigation of clarinet reed auto-oscillations with digital Fresnel holography

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This paper describes a full field digital holographic method for studying the cinematic of the vibration of the clarinet reed in playing conditions in an artificial mouth. Since many years, LAUM is interested in studying musical instruments and particularly the clarinet. The behaviour of such an instrument is particularly complex because it depends on aerodynamics, contact between reed and beak, and interaction with the lip of the musician. Thus, visualisation of the full movement of the reed in playing conditions is necessary to better understand physics of the clarinet. However, free oscillations have high amplitude of several hundreds of micrometers, thus corresponding to several thousand times the laser wavelength. The analysis of the movement is performed by a laser tracking of the vibration. It is demonstrated that it is possible to reconstruct a synthetic high amplitude deformation of auto-oscillations encoded with digital Fresnel holograms. The setup is applied to the auto-oscillation of the clarinet reed in a synthetic mouth. Tracking of the vibration is performed by using the pressure signal delivered by the mouth. Experimental results show the four steps of the reed movement and especially emphasize the shocks of the reed on the mouthpiece.