SFB 767 Seminar

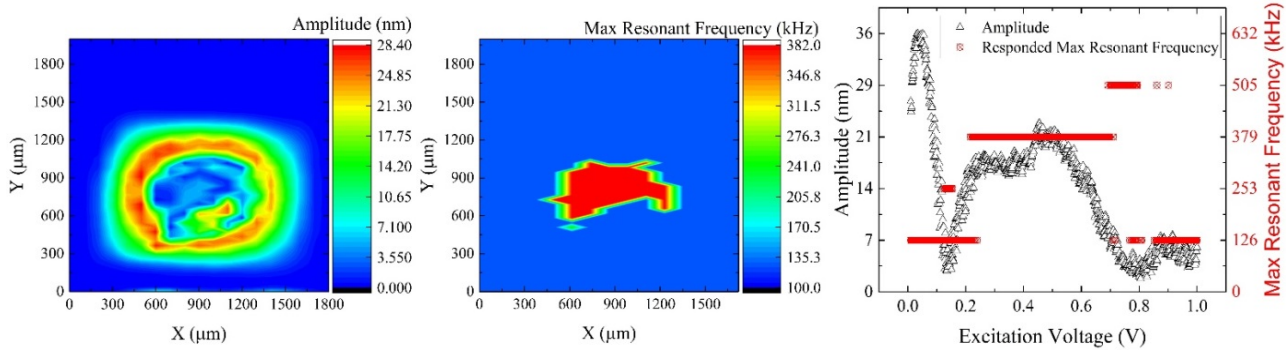
Fr 6 Jul 2018
10:00
P 602

MSc Lei Qing Zhou

University of Warwick

Non-linear vibrational response of membranes

Microelectromechanical systems (MEMS) have attracted much attention over the last few decades. The simplest structure is a suspended membrane, which can be used as a platform for integrating devices such as photonic detectors. In order to understand the behaviour and longevity of sub-micro or nanometre thickness membranes, we measured the resonant vibration modes at ultrasonic frequencies. The membranes demonstrate a nonlinear dynamic with super-harmonic resonances as the vibration amplitude is increased. Temperature effects due to the measurement technique or the temperature of the environment can also lead to changes in the resonant behaviour, as can damage to the membrane itself. The studied membranes are fabricated from three materials; single crystalline germanium, cubic silicon carbide, and silicon nitride, all with lateral dimensions from 2 mm down to 310 µm. The images below show a two-dimensional (2D) vibration pattern of a fundamental resonance mode exhibiting nonlinear behaviour with super-harmonics in part (a); (b) illustrates the strongest frequency at each position in the 2D scan; (c) shows the relationship between the membrane displacement, responded resonant frequency and voltage at the mid-point of the membrane. For membranes which are very small compared to the detection laser beam size, where the average vibration displacement over the whole membrane is measured rather than at single points, the classical non-linear behaviour is returned.



Contact:
E. Scheer, 4712

sfb767.uni.kn