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# Python-based Automatic Control System for Frequency-Response Measurement of the Quartz Tuning Fork

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The quartz tuning forks (QTF) is a high quality factor (Q-factor) mechanical resonator and therefore high sensitivity to the surrounding environment. Owing to the piezoelectricity of the quartz, the compact driving system can be achieved by attached electrodes on the QTF. Therefore the QTF, attached with a sharp optical fiber or tungstein tip, is widely utillized as a shear force sensing probe in NSOM or AFM. The readout electrical signal of the scanning QTF probe over the sample's surface and the feedback control system of the probe's height render the topographical image of the sample. The sensitivity and response time of the feedback system is specified by the Q-factor which can be determined from the frequency response curve of the QTF.

Here, we present an automatic control system for frequency-response measurement of the QTF. The frequency sweep of the driving signal and the signal readout of the QTF are controlled automatically by a python-based software, developed in this research. The software provides GUI for users to choose the number of data points for the frequency sweep, the frequency range and the amplitude of the driving signal. Additionally, the frequency response curve and the Q-factor calculation can be displayed after the end of the frequency sweep.

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