Compact MEMS/NEMS characterization platform using a DVD optical pick-up unit with optical imaging function

In this work, we present a compact, simple and efficient platform for Micro-electromechanical systems (MEMS)/Nano-electromechanical systems (NEMS) characterization. In this platform, a CCD camera is combined with a DVD optical pick-up unit (OPU). The CCD camera captures optical image of MEMS/NEMS samples and detection laser spot, which makes laser alignment on measurement target easier. The DVD OPU is used for detection of resonant frequency measurements of the samples. Working bandwidth and noise level of the OPU are 100 MHz and 1.3 pmHz\(^2\), respectively. Furthermore, the OPU has a laser spot size of 560 run (full width at half maximum, FWHM), which is capable of measuring cantilevers and strings with sub-micron width. A homemade nano-scale resolution X-Y-Z positioner with working distances of 12, 12, 5 mm is responsible for laser-sample alignment. Both thermal and excited resonant frequencies of MEMS/NEMS cantilevers and strings are characterized.