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Paper

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## **Stylus Probe Microscopy with Kalman Filtering and Multi-sensor Data Fusion**

This work is to teach the students of Mechanical Engineering how to integrate a lever arm with stylus probe , force actuator , load cell , personal computer , and XYZ-stages into a micro-force-controlled Scanning Probe Microscopic(SPM) system , such that the surface of the sample would not be destroyed by the contact force produced by the stylus probe . In order to raise the performance of the system , we set up an optical system , which is accomplished by placing a reflective mirror at the upper middle point of the lever arm , then a microscope as well as a CCD camera are used to magnify and detect the reflect beam displacement of a He-Ne laser . In addition , we apply the Kalman Filter estimation technique respectively to the measurements obtained by either Z-stage or optical system first , and then integrating the filtered results by multi-sensor data fusion method to raise the performance of the SPM system . To the author's knowledge, this method was not published before .