

Profiler Design with Multi-Sensor Data Fusion Methods

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Abstract

This research integrated a balance with stylus probe, force actuator, LVDT (Linear Variable Differential Transformer), load cell, personal computer, and XYZ-stages into a contact force-controlled Scanning Probe Microscope (SPM) system, such that the surface of the sample would not be destroyed by the contact force produced by the stylus probe. By using PI controller, the contact-force of the probe was feedback for monitoring the force actuator to meet the desired contact-force between the probe and the object as well as to minimize the hysteresis effect of the force actuator. In order to raise the performance of the system, an optical system as well as a piezo-stage were also set up and applied, the optical system was accomplished by placing a reflective mirror at the upper middle point of balance lever arm, then a microscope as well as a CCD camera were used to detect the reflective beam displacement of a He-Ne laser. Thus one can apply the Kalman filtering technique respectively to the measurements obtained by either electro-mechanical or optical system first, and then integrating these two results by multi-sensor data fusion method to raise the performance of the system.

Keyword : Multi-Sensor Data. LVDT. CCD camera. Kalman filtering