

Intelligent Fuzzy Control of a Scanning Probe Microscope System Design

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Abstract

This research is to use intelligent fuzzy control for a Scanning Probe Microscope (SPM) system design to reduce the hysteresis effect of the force actuator. In which a balance with stylus probe, force actuator, LVDT (Linear Variable Differential Transformer), Linear Velocity Transducer (LVT), load cell, personal computer, and XYZ-stages was integrated into a contact-force-controlled SPM system, such that the surface of sample would not be destroyed by the contact force of stylus probe. An intelligent Proportion and Derivative (PD) type fuzzy controller, instead of the PI compensator in the previous one, was applied in the design. Noted that the triangular distribution functions are applied instead of Gaussian ones, because the computation times for the former can be reduced. This improvement is better and has been verified by MATLAB simulation and practical implementation of a surface profiler. Finally, the profile of the object surface is displayed on a 3D graph.

Keyword : LVDT, Load cell, Surface profiler, Intelligent fuzzy control, Hysteresis effect