Ziegler-Nichols Based Intelligent Controller Design of a SPM System

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Abstract

This work applied a vertical probe without the balance and lever arm as in the previous design of a Scanning Probe Microscope (SPM) system. Ziegler-Nichols-based PID and the intelligent fuzzy methods are also integrated for the controller design, thus the relative stability can be reserved at the nominal condition. Besides, even the system with parameters variation we can see not only the voice coil hysteresis effects are reduced to one fifth, but the respond speed is also increased by five times. So both the accuracy and response speed can be increased. This effect is not discussed before. Comparing the results with the design by the traditional Ziegler-Nichols-based PID controller, we find this system is more robust.

Keyword：Intelligent fuzzy controller; hysteresis effect;LVDT; load cell; parameter variation; SPM; Ziegler-Nichols method