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Abstract

An Investigation on Nanomanipulation Based on Atomic Force Microscope

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Nanomanipulation is defined as the manipulation of atomic or molecular scale objects with (sub)nanometer precision. It is an important "bottom-up" method to fabricate and assemble nanostructures, especially for the asymmetrical structures. Nanomanipulation can also be used to repair or modify nanostructures built by other means. It has great potential for the nanotechnology.

Nanomanipulation based on AFM (Atomic Force Microscope) has become popular in recent years. The aim of this research is turning a commercial AFM from an imaging tool into both an imaging and a nanomanipulation tool.

In this thesis, we shall first introduce nanomanipulation and AFM basically. Then we will review previous works on nanomanipulation, especially on AFM-based nanomanipulation. To set up an AFM-based nanomanipulation system, we will introduce a commercial AFM—CSPM4000, propose a feasible manipulation strategy, and build the system setup. In order to model and optimize the system, we will analyze and model the AFM probe cantilever which is used both as nanomanipulator and a sensor, and model the interactive forces at nano scale on basis of nano mechanics. To validate the effectiveness of AFM working as imaging and nanomanipulation tool, calculations and preliminary experiments are carried out. Finally, discussions are given, and more challenging problems are concluded as the future research recommendation.