URN etd-0407109-183710-732
Author Sheng-Hao Fan
Author's Email Address No Public.
Statistics This thesis had been viewed 52 times. Download 0 times.
Department
Year 2003
Semester 2
Degree Master
Type of Document Master's Thesis
Language zh-TW.Big5 Chinese
Title Development of Nano-positioning Stage and Optical Displacement Measurement System
Date of Defense 0000-00-00
Page Count 73
Keyword
Nano-positioning Stage

Abstract Abstract

With the development of precision industry, miniaturization and precision have become the trends of the times. Due to developments in this direction, there are increasing demands for micrometer and even sub-micrometer positioning systems. In the past, the lateral offset error produced during the displacement enlargement of positioning devices affected the accuracy of positioning, and the high sensitivity sensing devices used by measurement systems are expensive. Therefore, this article, using an existing piezo-element as actuator and based on the theory of elastic deformation, designs and manufactures a nanopositioning stage. After compacting the linear output characteristics and structure of the nanopositioning stage, it drives the stage to make long travel positioning in conjunction with the stick-slip effect as a linear micropositioner of a long travel piezoelectric-driven linear nanopositioning stage. Finally, a precise Laser Diffraction Grating Interferometer as a low cost Optical Displacement Measurement System has been developed.

During the designing stage, the linear nanopositioning stage was built on the basis of finite element method theory and the design was carried out in conjunction with the result of ANSYS finite element software analysis. Appropriate design parameters are selected with due consideration of factors such as displacement, stress, and dynamic response, and prototypes were developed through precise linear Electro-Discharge Machining (EDM). And regarding the application of long travel positioning, a precision cylinder is used as a linear guide, which can effectively improve the linear positioning resolution capability of the system. In addition, theory analysis, optical design and tests were conducted aimed at a Laser Diffraction Grating Interferometer.

Experiment demonstrated takes the laser interferometer as the standard of displacement measurement. The result of experimental measurement shows that the maximum displacement travel of the nanopositioning stage is 46μm; displacement resolution is 8nm and the lateral angular deviation is less than 2μrad. The possibility of driving the stage to make long travel precise positioning with a step size of 70nm~35μm was realized, whereby the minimum displacement resolution is 10nm, and the straightness error is less than 50nm. Finally, in comparing the stage displacement value of 83.86μm measured with the optical measurement system with 83.97μm measured with standard laser interferometer.
Advisory Committee - advisor

Files No Any Full Text File.
Date of Submission 2004-07-19