NISTTech

Positioning Stage

Accurate x-y motion positioner for precision nanomanufacturing

Description

This invention is a positioning stage is for fine precision object manipulation in manufacturing and assembly processes. These objects can range from large objects, macro-scale objects, to very small objects, commonly referred to as micro-scale objects.

The positioning device of the invention includes a movable stage. The movable stage is where objects to be positioned are placed for positioning. The movable stage has two perpendicular axes, Y-axis and X-axis. The axes preferably intersect at the center of the movable stage. In this preferred configuration, each axis divides the movable stage into two halves.

The device delivers x-y linear motion ranging from less than a nanometer to 500 microns with an angular deviation of less than a tenth of current available products. The design makes use of dual parallel pairs of levers to generate perfectly straight line motions. This design has negligible wobble and crosstalk error thus eliminating the need for corrective motion action.

Benefits of this design include the use of embedded safety steps (door stops) which prevent the destruction of the mechanism if it is accidentally overloaded. A displacement sensor can be embedded into the device along the axis of the actuator, thus eliminating Abbe sine displacement measurement error (relation between displacement and incident angle). The design eliminates backlash and stiction.

These devices range in size from the macroscale (300mm x 300mm) to MEMS- scale (1mm x 1mm). Materials used to build these devices include aluminum, titanium, Invar®, steel, brass, and single crystal silicon. Capacitance displacement sensors have been embedded into the devices, and interferometers into the MEMS microscale devices.

Computer Assisted Designs (CAD) drawings and lithography mask designs are available for the above mentioned devices. A fully equipped laboratory is available to assist with the testing of the devices.

Note: Also see U.S. patent # 6,485,602, Six-degree of freedom micro-positioner under Citations below.

Images

Planar Ti (90 mm by 70 mm by 5 mm) Dual Parallel Pair Levers XY Axes Micro/ Nano Positioner with embedded overload protection

Applications

- **Precision manufacturing**
  Useful in the manufacturing of planar high-precision motion and metrology equipment

Advantages

- **Accuracy**
  Accurate 2D positioning--precision down to a fraction of a nanometer or 500 microns on the microscale
- **Various scales**
  Positioner available in micro-, meso-, and macro- scales

Abstract

A positioning device and method for positioning objects is provided. The device includes a movable stage and a pair of levers. The pair of levers is symmetric about a first axis of the movable stage. Additionally, the pair of levers is parallel to a second axis of the movable stage. This second axis is perpendicular to the first axis. Each of the pair of levers applies a force to the movable stage. Each of the pair of levers moves in an arc. The two levers move in opposite directions along their respective arc. The two arcs are symmetrical about an axis of the movable stage.

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Citations

1. U.S. Patent # 6,484,602, Six-degree of freedom micro-positioner
2. N.G. Dagalakis, J.A. Kramar, E. Amatucci, R. Bunch. Kinematic modeling and analysis of a planar micro-positioner. Proceeding of the ASPE. Vol 25, pp 135-138, 2001.
3. Precision Meso/Micro Systems for Nanomanufacturing

Related Items

- NIST Nanoscale Manufacturing Overview
- Performance Evaluation of a Parallel Cantilever Biaxial Micropositioning Stage
- MERWYN Business Simulation Report

References

- U.S. Patent # 6,467,761 issued 10-22-2002, expires 06/20/2020
- Docket: 99-017/-032/-037US

Status of Availability

active patent and available for licensing

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