

Development of a sensitive micro-angle sensor

JPAN 2004-299194

Background

Application

- Dynamic motion measurement of precision stage.
- Measurement of inclination of cantilever.
- Measurement of surface profile.

Requests to the angle sensor

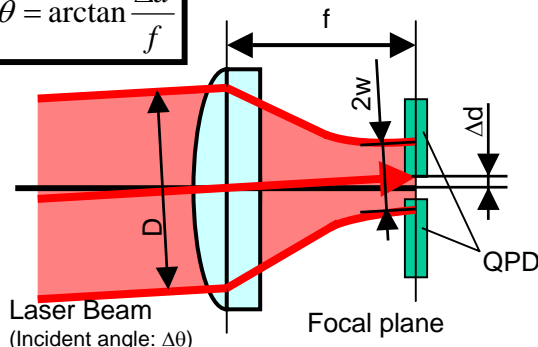
- High sensitivity
- High speed
- Compact
- Low cost

Principle of Angle Detection

Analyzed with wave optics

Autocollimation method & QPD

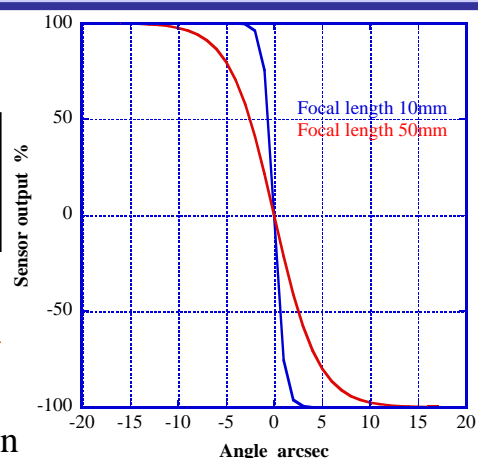
$$\Delta\theta = \arctan \frac{\Delta d}{f}$$



Sensitivity

$$\propto \frac{D}{\lambda}$$

Simulation



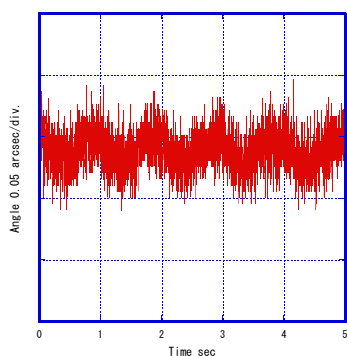
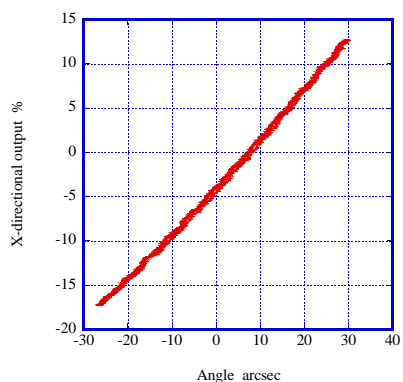
The sensor sensitivity is not influenced by the focal length of the objective lens

Experiments

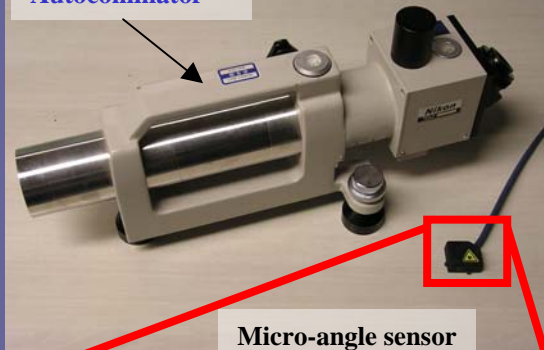
$f = 10\text{mm}$, $D = 1\text{mm}$, $\lambda = 635\text{nm}$

Output of the micro-angle sensor

resolution



Autocollimator



Micro-angle sensor

Specifications of the micro-angle sensor

- Sensor size 26mm(W) × 22mm(L) × 12mm(H)
- Resolution 0.05 arcsec
- Responsivity 5kHz

