PKA-ZPR-200 Parallel Kinematic Piezoelectric Stage

Dynamic Structures & Materials, LLC

Description

The PKA-ZPR-200 nanopositioning stage was developed for active alignment correction. It uses a parallel kinematic architecture for high stiffness and high resonant frequency with one translational degree of freedom and two rotational degrees of freedom. It features flexure-guided motion over a nominal 200 um displacement range. Rotational range of motion is greater than 4 mrad. The stage's stable and stiff kinematic design promotes dynamic responsiveness for excellent position stability and control. It is designed to include high-resolution metrology that, when combined with a suitable 3 channel low-noise piezoelectric amplifier, can deliver position resolution of 10 nm or better.

Highlights of the PKA Stage Design

- Flexure-guided for smooth, parallel motion
- Option for integrated metrology
- High natural frequencies and rapid response
- Linear displacement range of 200 µm
- Angular displacement > 4 milliradians
- Customizable and scalable for new applications

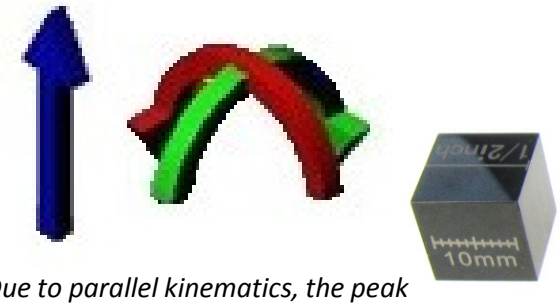
Applications

Parallel kinematic mechanisms are recommended for applications where high natural frequency and stiffness are needed with multiple degrees of freedom. Control of parallel kinematics is more complicated than stacked serial stages, so parallel kinematic designs are generally reserved for high performance systems.

Specifications

- Open-Loop Travel: 200 micron linear in Z
  > 4 mrad rotary X & Y
- Closed-Loop Resolution: metrology dependent –
  10 nanometers typical
  with capacitive probe
- Unloaded Resonant Freq: >590 Hz
- Resonant Freq with 500 g: >280 Hz
- Electrical Capacitance: 8 µF per channel
- Operating Temp Range: 25 to 50 degrees Celsius
- Dimensions: 72 mm diameter
  by 44 mm tall
- Material: Stainless steel or titanium
- Ultra-High Vacuum Compatible

The ZPR-200 translation is aligned with the Z-axis (blue arrow) with simultaneous rotation about the two orthogonal axes



Due to parallel kinematics, the peak displacement and peak rotation can not be achieved simultaneously. The range of motion is a function of the displacement and rotations combined.