Article published on February 17th 2012 | Business

Hybrid Motorized / PZT Precision Actuators

The combination of piezo-electric and motorized precision actuators is a new way of achieving the highest possible accuracy. Positioning systems with long travel ranges (several inches) and extremely high resolution (nanometers are feasible. Advanced servo controllers make possible tracing accuracy of less than 2 nanometers RMS. Hybrid precision drives are available integrated in actuator and motorized positioning table systems. Advantages are high forces to several 100 N and very low power dissipation, with position hold during power off.

A high precision optical sensor is used as position feedback system. Sensor resolution of 0.125 nm is feasible

Hybrid Motion Controller

The hybrid system motion controller runs two parallel loop structures â€“ one for the servo motor and one for the piezoelectric part of the system.

The architecture of the hybrid motion controller is based on a real-time operating system. It employs FPGA hardware-clock-buffered sensor inputs and synchronized output buffers. Fast communication is via SPI & Ethernet / TCP/IP interfaces.

The servo motors in the positioning table and actuator are driven by high resolution PWM signals; the piezo part of the hybrid system is driven by 24bit D/A converters resulting in a calculated command resolution of less than 1pm (picometer). The effective closed-loop system resolution is limited by the sensor-interpolator precision.

Advanced Piezo Motion Controller

A new digital servo design is available to provide much more robust rejection of external disturbances than conventional PID control. This allows higher bandwidth settings and with faster settling. The advanced controller can handle up to 6-axes for Active Trajectory Control (ACT) applications (ACT describes a control system that can monitor and compensate for undesired, off-axis motion).

Precision Motorized XY-Positioning Tables with Ultrasonic Ceramic Linear Motors

Ultrasonic motors provide high speed and better stability than conventional linear motors due to their intrinsic self clamping design. This is especially important in XY microscope table applications. The drift / time of conventional motorized positioning tables is typically several times larger than those of self-clamping piezomotor tables

Piezo Ceramic Motors Team up to drive Ultra-Low Profile Rotation Table

Ultrasonic ceramic motors can be combined in groups of 2 or 3 to drive rotary positioning tables. The crux is to get all motors to resonate in synch so the net drive forces will add up rather than cancelling each other out. For the designer this requires a fundamental understanding of vibrational modes and behavior of the motor itself and the system as a whole unit. Laser vibrometry is one of the tools available to the modern motion control engineer to improve performance of these types of

motors.

One of the advantages of ultrasonic piezo motors is their very low profile. This advantage is also carried over to any motorized positioning stage they are being integrated in. One example is the PIline M-660 rotation table which stands out with its 14 mm (0.6in) profile and 720 degrees/sec speed, along with a very high positioning resolution of 4 micro-radians (0.00023 degrees) courtesy of a direct optical encoder. The encoder provides phase-lag-free, backlash-free feedback to the servo controller and the self-clamping ceramic drive provides very high stability, with no energy consumption at rest and no heat generation.

Article Source:
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Article Keywords:
precision positioning

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