

Sensor Layouts for a Long-Stroke Nano-Positioning Stage

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Abstract

This paper proposes two sensor layouts for a long-stroke nano-positioning stage, that consists of a piezoelectric-transducer (PZT) stage and a stepper-motor stage to achieve a travelling range of 10cm with a root-mean-square error of less than 5nm. The system is developed by three steps. First, we identify the transfer functions of the stepper-motor and PZT stages, and design robust controllers to independently regulate the two stages. Second, we integrate the two stages to achieve nano-positioning within a long travelling range, and design two control loops by different sensor layouts. Last, the designed control structures were implemented for experimental verification. Based on the results, both sensor layouts are compared and deemed effective in achieving high precision and fast responses over a long stroke.