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Comparison Between Three Tuning Methods of PID Control for High Precision Positioning Stage

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Abstract
Advances in micro and nano metrology are inevitable to satisfy the need to maintain product quality of miniaturized components by the utilization of well controlled positioning stage. Proportional, integral and derivative (PID) control has been proved to have most robust and simpler performance. However, tuning of the key parameters of a PID controller is most inevitable to build a robust controller to accomplish high precision positioning performance. Therefore, many tuning methods are proposed for PID controllers. In this work, three tuning methods, namely, Ziegler–Nichols step response method, Chien–Hrones–Reswick method and Cohen–Coon method are compared for PID control of a single axis of a XY stage of a 3D surface profiler. Positional errors are also measured using a miniature plane mirror interferometer. Cohen–Coon method is found to be the best technique to minimize the controller error.

Keywords
PID control – Tuning – Controller error – Positional error – Miniature interferometer