REAL-TIME MOTOR CONTROL SYSTEM FOR BEAMLINES
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INTRODUCTION
Closed-loop control is a vital part of a control system. The parameters of closed-loop control and the advantage and disadvantage of an analog input/output system will lay influence on the control system results. This text is designed to discuss about the applications for Closed-loop control and analog input/output system, in order to enhance the stability and accuracy of beamline motor control system. Consequently, we adopt analog input/output system, FPGA and closed-loop control for design.

Because the stepper motor equipped with a reducer can analyze mobile platform to 10 nanometers per stepper, with FPGA accompanied to simultaneously trigger the activation of an analog input/output system, the addition of a closed-loop control mode firmware into this hardware structure can enhance the stability of the beamline motor system, and the convenience of real-time adjustment against stability. Thus, the beamline control system will be about stability, accuracy and convenience.

SYSTEM ARCHITECTURE
The control system structure in this text is designed by way of R-T closed-loop control, with the analog in-put/output module acting as the reading and processing center, and FPGA module and firmware controllers acting as the hardware. The computer end serves to give location orders and besides, the stepper motor serves as the hardware of actual motion and the reading sensor serves to return its actual moving distance for the Encoder.

FIRMWAVE CONTROL
To enhance stability and instantaneous, the integration of firmware's closed loop controls and motor controllers is used to maintain the accuracy of required locations through reduced time of communication with computers. In the following procedure of firmware's closed loop control, the required location is identified through analog output on the computer. While the location information required by controllers through analog input is digitized by way of the firmware program, the closed loop controlled module of the firmware system will initiate location modification. Since there's the farthest distance between the starting point and the targeted one, the enhanced motion distance will be the likewise farthest. The shorter motion distance is then used to make modifications. While the location is reached within the range of tolerable errors, the closed loop control will run into a status of placidity and the entire system will run stably. In this state of stability, if any displacement takes place, the system will move its structure to a correct position in order to lock in the location.

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REFERENCES