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A METHOD FOR IMPROVEMENT OF POSITION CONTROL BY USING ANALOG FEEDBACK SIGNAL

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Abstract. *In this paper, we propose a method for improving a position control by using a sliding mode control. For industrial equipments, a pulse encoder is generally used for measurements of a position, but a positioning cannot always be completed due to quantization errors which fluctuate with a resolution of the pulse encoder. It is known that this problem can be solved by so-called analog clamp method that uses two analog sinusoidal signals which are generated in the position sensor. However, a transmission data quantity increases when the analog signals are passed through a serial transmission. Therefore, we propose an analog clamp controller which evaluates a control condition on a sliding mode plane. Effectiveness of the proposed method is confirmed by experiments.*
Keywords: Sliding mode control, Analog clamp, Noise reduction observer

1. **Introduction.** Recently, in order to improve productivity, requirements for high-speed and high-precision positioning control of industrial equipments, such as robots and machining centers, has become greater. At the same time, as the mechanisms of industrial equipments are becoming more complicated with a goal to realize multiple functions, it is more difficult to achieve high-precision positioning control. In such a situation, many researchers have been studying and proposing new methods, such as a method to derive more precise mathematical model of the controlled objects or applied identification methods for non-linear parameters [1],[3],[14]. A servo controller, which has a PID control strategy, is widely used for high-speed positioning control of industrial equipments. To satisfy the above requirements by the PID control strategy, it is required to make sampling period as short as possible and make a resolution of an encoder as high as possible.

Because a controller of the industrial equipment uses position data measured by a pulse encoder, it is impossible to control position under a resolution based on the pulses from the encoder. Moreover, a velocity is generally calculated by the backward difference approximation which uses pulse counts per sampling period. By this method, when a target decelerates toward the end of positioning, the number of pulses per sampling period decreases and is therefore difficult to calculate the velocity correctly. As a result, a vibration called "a limit cycle" with amplitude of a few pulses occurs. This phenomenon