# A Study on Servomotor Control

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Servomotor control is one of the key technologies in factory and office automation. This study aims to develop the high performance servo drives of DC brush and brushless servomotors for position and speed control.

The dissertation consists of five chapters. Chapter 1, Introduction, describes the background and the object of the present study.

Chapter 2 describes a new pulse-width-modulator (PWM) for high efficiency, bidirectional drive of a DC servomotor. Comparing a control input with the positive-and negative-going sweeps phase-shifted by 180° each other, it generates two PWM signals, one for clockwise and the other for counterclockwise drive of the motor. The timing of these PWM signals is arranged such that only one of the two current paths in a power bridge is activated depending on the polarity of control input. Therefore, this scheme is useful for reducing the power consumption of the bridge, and prevents the bridge from being short-circuited.

Chapter 3 presents a hybrid digital and analog position controller of the DC servomotor. It consists of two positioning loops: the digital positioning loop to control the rotation angle and speed of the rotor, and the analog positioning loop to lock the rotor to a specified position. This architecture has resolved the contradictory problem of reducing a tracking error in the dynamic state and increasing a stability in the static state. The whole controller is realized in a compact form by integrating the digital and analog parts into CMOS monolithic and hybrid IC forms, respectively.

Chapter 4 gives a microstep controller of the DC servomotor. It converts one period of quadrature sinusoidal signals generated by the incremental encoder attached to a motor shaft into four quarter sections, and divides each section further into N equiangle segments. The resultant step angle is 90° /NR, where R is the number of slits on a rotary disk in the encoder. Therefore, fine positioning and smooth movement at low speed can be enabled.

Chapter 5 concludes the dissertation with the brief summary of the results obtained in this study.