

Improved Utilization of DC Intermediate Circuit Voltage for Sliding Mode Control PMSM Drive

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Abstract: *In order to optimize the dynamic performance of the permanent magnet synchronous motor (PMSM) speed regulation system, a nonlinear speed-control algorithm for the PMSM control systems using sliding-mode control (SMC) is developed. First, a sliding-mode control method based on a new sliding-mode reaching law (NSMRL) is proposed. This NSMRL includes the system state variable and the power term of sliding surface function. In particular, the power term is bounded by the absolute value of the switching function, so that the reaching law can be expressed in two different forms during the reaching process. This method can not only effectively suppresses the inherent chattering, but also increases the velocity of the system state reaching to the sliding-mode surface. Based on this new reaching law, a sliding-mode speed controller (SMSC) of PMSM is designed. Then, considering the large chattering phenomenon caused by high switching gain, an improved anti-disturbance sliding-mode speed controller (ADSMSC) method, called SMSC+ESO method, is developed. This method introduces an extended state observer (ESO) to observe the lumped disturbance and adds a feed forward compensation item based on the observed disturbances to the SMSC. Finally, simulation and experimental results both show the validity of the proposed control method.*

Keywords: PMSM (Permanent Magnet Synchronous Motor) SMC (Sliding-Mode Control) NSMRL (New Sliding-Mode Reaching Law)

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