
# NEW ADAPTIVE SLIDING-MODE OBSERVER DESIGN FOR SENSORLESS CONTROL OF PMSM IN ELECTRIC VEHICLE DRIVE SYSTEM

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***Abstract- In this study, a new adaptive sliding-mode observer is proposed to estimate the rotor position and speed for sensorless control of permanent-magnet synchronous motor (PMSM) in an electric vehicle drive system. This observer can effectively reduce the estimation errors caused by the inherent chattering phenomenon for a conventional sliding-mode observer and the stator resistance uncertainty due to the variation of motor temperature. This new sliding-mode observer is designed by using a hyperbolic tangent function instead of sign function together with a variable boundary layer, and the new adaptive law is constructed according to the back electromotive force model to reinforce dynamic performance and the robustness of system. Meanwhile, a stator resistance identification algorithm is raised and guaranteed to be stable by using a Lyapunov method. The performance of the developed observer is compared with the conventional sliding-mode controller. Both simulation and experimental results confirm that the chattering phenomenon is effectively eliminated and the estimation accuracy for position and velocity is apparently improved when applying the developed observer in the electric vehicle drive system.***

**Index terms*:* PMSM, adaptive sliding-mode observer, sensorless control, electric vehicle drive system, resistance identification.**