

# Improved double-surface sliding mode observer for flux and speed estimation of induction motors

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## Abstract-

This study studies a double-surface sliding-mode observer (DS-SMO) for estimating the flux and speed of induction motors (IMs). The SMO equations are based on an IM model in the stationary reference frame. The DS-SMO is developed based on the equations of a single-surface SMO (SS-SMO) of IM. In DS-SMO method, the observer is designed through combining sliding variables produced by combining estimated fluxes of currents error. The speed is easily determined based on the pass of switching signal through a low-pass filter. Also, an optimal DS-SMO (ODS-SMO) is proposed to improve the transient condition by optimally tuning the observer parameters. To optimise these parameters, the particle swarm optimisation method is adopted. Moreover, an improved DS-SMO (IDS-SMO) is proposed to improve both transient and steady-state conditions, torque ripple and total harmonic distortion. Moreover, the proposed IDS-SMO has a stable performance under sudden load change and the low-speed region. Finally, the accuracy of the proposed ODS-SMO and IDS-SMO methods is substantiated through simulation and experimental results.

## Index Terms-

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