Lehrstuhl für Elektrische Antriebssysteme und Leistungselektronik
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The Performance Improvements of Self-sensing Control for Permanent Magnet Synchronous Machines

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Abstract

This thesis presents a general solution for the problem of position self-sensing with surface-mounted permanent magnet synchronous machines at zero and low speeds using high frequency signal injection, and introduces two different novel designs of interior permanent magnet synchronous machines with concentrated windings which are attractive to the self-sensing control system and have been verified by respective experimental results. Furthermore, considering the efficiency optimization, the extra losses in a permanent magnet synchronous machine resulting from the high frequency injection are analyzed. By using the proposed observer-based model predictive torque control scheme, the closed-loop self-sensing technology of a permanent magnet synchronous machine can be achieved.

Kurzzusammenfassung

Diese Arbeit zeigt eine funktionsfähige Lösung für die Geberlose Positionserfassung bei niedrigen Drehzahlen und im Stillstand für permanenterregte Synchronmaschinen mit Oberflächenmagneten mit Hilfe der Einspeisung hochfrequenter Signale. Zwei unterschiedliche neuartige Maschinendesigns von Synchronmaschinen mit vergrabenen Magneten und konzentrierten Wicklungen die für die Geberlose Regelung geeignet sind wurden vermessen. Weiterhin wurden die zusätzlichen Verluste, die in der permanenterregten Synchronmaschine aufgrund der hochfrequenten Signale entstehen analysiert mit dem Ziel der Wirkungsgradoptimierung. Durch die vorgestellte Methode der modellprädiktiven Drehmomentregelung wird ein Geberlose Regelung für die permanenterregte Synchronmaschine realisiert, die auf einem Beobachter basierend.

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