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Modelling and Detecting the Demagnetization Fault in the Permanent Magnet Synchronous Machine Using the Current Signature Analysis

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Abstract : Several kinds of faults can occur in a permanent magnet synchronous machine (PMSM) systems: bearing faults, electrically short/open faults, eccentricity faults, and demagnetization faults. Demagnetization fault means that the strengths of permanent magnets (PM) in PMSM decrease, and it causes low output torque, which is undesirable for EVs. The fault is caused by physical damage, high-temperature stress, inverse magnetic field, and aging. Motor current signature analysis (MCSA) is a conventional motor fault detection method based on the extraction of signal features from stator current. a simulation model of the PMSM under partial demagnetization and uniform demagnetization fault was established, and different degrees of demagnetization fault were simulated. The harmonic analyses using the Fast Fourier Transform (FFT) show that the fault diagnosis method based on the harmonic wave analysis is only suitable for partial demagnetization fault of the PMSM and does not apply to uniform demagnetization fault of the PMSM.

Keywords : permanent magnet, diagnosis, demagnetization, modelling
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