Fault Detection of PMS Motor Mated to Gear Box by Monitoring Inverter Input Currents

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In the sectors of propulsion, aviation (More Electric Aircraft), and maritime operations, electric power systems and control have advanced dramatically. It is crucial to detect the emergence of fault conditions in the early stages while using the systems in critical environments. Vibration analysis, thermal analysis, flux measurement analysis, and motor current signature analysis (MCSA) are some of the existing methods for monitoring motor status. The purpose of this research work is to track the input currents to the inverter and analyze the motor state using the fault signal that is propagated from the torque disturbance on the motor shaft. This research suggests a fault detection methodology for DC supplied permanent magnet synchronous motor (PMSM) drive systems because the prior method involved monitoring the drive DC input current. This method's basis is the transmission of failure signals from the torque disturbance on the motor shaft to the inverter input currents. The accuracy of this fault signal propagation is validated by MATLAB simulation with experiment tests at actual defective conditions. The feasibility of this approach is demonstrated by the experimental test that the Spectra test rig carried out using an actual gearbox failure. This detection system can also be used to monitor other drive devices, such as the power converter or the motor itself, using just one set of current transducers mounted at the DC input side. Because the other approaches have space and reliability issues, this method of analysis was specifically chosen. When employing integrated drives or owing to other factors, it becomes impractical.

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Contents

In the sectors of traction, aviation (More Electric Aircraft), and maritime operations, electric power systems and control have significantly improved. It is crucial to detect the emergence of fault conditions in the very early stages when using systems in critical environments. Vibration analysis, thermal analysis, flux measurement analysis, and motor current signature analysis are all methods for monitoring motor status that are now available [1]. MCSA detects changes in the harmonic content of the motor's stator currents (more accurately, supply current) to signal faults in the machine by measuring and processing them. The motor stator windings, which act as a transducer in MCSA, pick up the signals (induced currents) from the rotor. [2]. In other circumstances, such as when the power converter and the motor are connected, measuring the machine currents is impractical. The goal of this research work is to track the input currents to the inverter and analyze the motor state using the fault signal that is propagated from the torque disturbance on the motor shaft. Because the previously listed approaches have space and reliability difficulties, this method of analysis was especially chosen. It also becomes impractical when employing integrated drives or when individual units are difficult to access.