Experimental evidence of MCSA for the diagnosis of ball-bearings

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Electrical and mechanical fault diagnosis in induction machines is an extensively investigated field for cost and maintenance savings, as induction motors operating at mains frequency are still the most widespread rotating electric machines in industry. Many papers can be found in the literature concerning the general condition monitoring of induction machines [1]. Bearing faults are one of the most common failures in electrical machines especially in the small-medium power sizes. Bearing faults that are not detected in time cause malfunction, loss of performance, reduced efficiency, and may even lead to failure of the driven machinery. Online fault detection can be obtained by vibration analysis [2], but the diagnosis equipment is costly and invasive, requiring dedicated equipment and specific sensors to be installed. Motor current signature analysis (MCSA) is an alternative method that relies on the monitoring of electrical quantities, that are already acquired in the final application, e.g., to implement the control of an electric drive, thus do not require the installation of dedicated transducers. Many research activities were focused on the diagnosis of bearing faults by MCSA [3]. The use of suitable signal processing techniques is required to efficiently extract the fault signatures from raw signals. The use of current and/or voltage signal constitutes a noninvasive method to bring information necessary to diagnose a fault in the system via online monitoring of the electric machine [4].
This paper details the results of a laboratory trial (Figure 1) comprising different test sets on the condition monitoring and fault diagnostic of a six-poles induction motor using a design of experiment (DOE) approach. The paper discusses the results of MCSA compared to vibrational data and the perspectives offered by long short-memory networks.

Keywords: MSCA, condition monitoring, ANOVA, long short-memory networks.

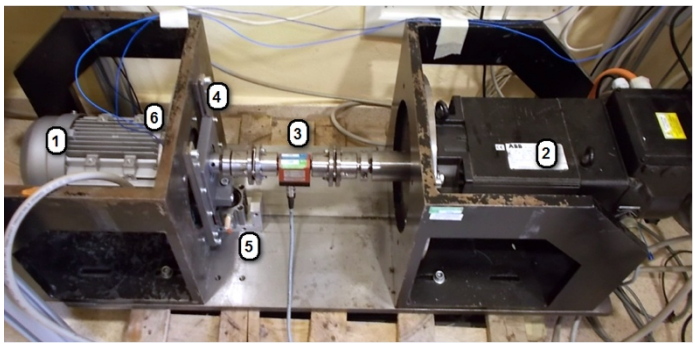

Figure 1: Test setup overview: (1) MUT, (2) brake/dynamometer, (3) torque meter, (4) crosshead, (5) pneumatic cylinder, and (6) accelerometer position.

References

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