Summary:

The main objective of this Thesis is the performance and validation of an automatic diagnostic system for induction motor failures, based mainly on the use of Infrared Thermography Technique.

The implementation of these systems allow the detection of the failures in advance, when they are still in an incipient state, from information provided by various magnitudes of the machine, is a milestone pursued by many researchers. However, these predictive maintenance systems must possess high reliability making them suitable for a wide variety of industrial applications. Up till today, no predictive maintenance system, fully consistent and valid for the detection of a wide range of faults in electric induction motors, has been developed.

The development of such systems becomes more relevant in the current context, in which the mentioned electric machines are expanding to other emerging applications, such as wind generation and driving electric vehicles.

This development process consists of several complementary stages.

The first phase is focusing on obtaining the thermal model, based on the energy balance of the induction motor as well as the heating curves, with the use of Infrared Thermography and the Heat Transmission Theory. This model, validated after applying it to various assemblies, will accurately predict the heating curves of the motors under different operating conditions or even in fault condition.

The second stage involves the detailed analysis of the information from the infrared images obtained experimentally from the different case studies, in order to obtain the relevant data to make a more accurate diagnosis.

The third step consists on the combination of the infrared thermography and the motor current signal analyses. The coupling of both will increase the diagnosis reliability and expand its applicability to a wider range of faults.

Finally, the postprocessing of the data gathered from the previous stages using artificial intelligent algorithms, based on the recognition of thermal patterns, will be integrated into the automatic diagnostic system. These systems are able to minimize the human intervention in the detection process with a consequent increase in effectiveness. The future implementation of these predictive diagnostics systems may well consist of portable diagnostic equipment adapted to industrial environments.

The Thesis is presented in the format of articles' compilation. It includes the two articles published in indexed journals and presented in international conferences, performed in collaboration with world renowned groups and covering the different areas and stages described.