Resumen de Tesis Doctoral

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Título de la tesis	Fault Diagnosis and Fault Tolerant Control of Multiphase Voltage Source Converters For Application in Traction Drives
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(Mínimo 1 y màximo 4, podéis verlos en http://doctorat.upc.edu/gestion-academica/carpeta-impresos/tesis-matricula-y-deposito/codigos-unesco)

Resumen de la tesis de 4000 caracteres máximo (si se superan los 4000 se cortará automáticamente)

There is an increasing demand for vehicles with less environmental impact and higher fuel efficiency. To meet these requirements, the transportation electrification has been introduced in both academia and industry during last years. Electric vehicle (EV) and hybrid Electric vehicle (HEV) are two practical examples in transportation systems.
The typical power train in the EVs consists of three main parts including energy source, power electronics and an electrical motor. Regarding the machine, permanent magnet (PM) motors are the dominant choice for light duty hybrid vehicles in industry due to their higher efficiency and power density.
In order to operate the power train, the electrical machine can be supplied and controlled by a voltage source inverter (VSI). The converter is subjected to various fault types. According to the statistics, 38% of faults in a motor drive are due to the power converter. On the other side, the electrical power train should meet a high level of reliability. Multiphase PM machines can meet the reliability requirements due to their fault-tolerant characteristics. The machine can still be operational with faults in multiple phases. Consequently, to realize a multiphase fault-tolerant motor drive, three main concepts should be developed including fault detection (FD), fault isolation and fault-tolerant control. This PhD thesis is therefore focused on FD and fault-tolerant control of a multiphase VSI.
To achieve this research goal, the presented FD and control methods of the power converter are thoroughly investigated through literature review. Following that, the operational condition of the multiphase converter supplying the electrical machine is studied.
Regarding FD methods in multiphase, three new algorithms are presented in this thesis. These proposed FD methods are also embedded in new fault-tolerant control algorithms. At the first step, a novel model based FD method is proposed to detect multiple open switch faults. This FD method is included in the developed adaptive proportional resonant control algorithm of the power converter. At the second step, two signal based FD methods are proposed. Fault-tolerant control of the power converter with the conventional PI controller is discussed. Furthermore, the theory of SMC is developed.
At the last step, finite control set (FCS) model predictive control (MPC) of the five-phase brushless direct current (BLDC) motor is discussed for the first time in this thesis. A simple FD method is derived from the control signals. Inputs to all developed methods are the five-phase currents of the motor.
The theory of each method is explained and compared with available methods. To validate the developed theory at each part, FD algorithm is embedded in the fault-tolerant control algorithm. Experimental results are conducted on a five-phase BLDC motor drive. The electrical motor used in theexperimental results has an in-wheel outer rotor structure. This motor is suitable for electric vehicles. At the end of each part, the remarkable points and conclusions are presented.

Lugar Terrassa Fecha 19 - June - 2014

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