PhD position at IFP Energies nouvelles (IFPEN)
Electrical engineering, electronics, computer engineering

Characterization and modeling of Partial Discharges (PD) in the windings of electrical machines for automotive traction

The massive introduction of electric vehicles presently is a key contributor to make automotive transport more durable. This in particular requires the ability to design more efficient and low-cost electric powertrains in order to increase the vehicles' autonomy and to make them more competitive on the market.

In this context, a key challenge is the usage of electric components with high power and torque density. This induces increased levels of DC bus voltage, as well to the need for employing new wide-band gap semiconductor materials (SiC and GaN). As a result, steeper voltage fronts are encountered in the windings, that can favour of a rapid electrical ageing if the threshold of appearance of partial discharges (PD) is reached. The objective of the PhD thesis is to develop a methodology for characterizing and modeling partial discharges, while considering the impact of the feeding inverter and of environmental parameters. During a first experimental part, the PhD student will be in charge of developing an experimental methodology to characterize the voltage distribution in a winding subjected to steep voltage fronts under conditions representative of realistic operating and environmental parameters, and to further develop it to study and characterize the Partial Discharges Inception Voltage (PDIV). During an ensuing modeling phase, the PhD student will develop a predictive model for the voltage distribution in the windings as a function of temperature and frequency variations, as well as a predictive model of the Partial Discharges Inception Voltage (PDIV).

Keywords: Electric system, electric machines, windings, insulation, inter-turn voltage, overvoltage, partial discharges, reliability, wide gap converter.

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Doctoral School	Doctoral School « Sciences pour l'ingénieur de Lille (ED072) », http://edspi.univ-lille1.fr
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PhD location	IFPEN, Rueil-Malmaison, France
Duration and start date	3 years, starting in the fourth quarter of 2022
Employer	IFPEN, Rueil-Malmaison, France.
Academic requirements	MSc in electrical engineering
Language requirements	Fluency in French and English

To apply, please send your cover letter and CV to the IFPEN supervisor indicated here above.

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