Title :
Control optimization of electric machines for the minimization of acoustic noise

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Laboratories:
FEMTO-ST (Franche-Comté Electronique Mécanique Thermique et Optique – Sciences et Technologies) is a joint research unit which is affiliated with the French National Center of Scientific Research (CNRS), the University of Franche-Comté (UFC), the National School of Mechanical Engineering and Microtechnology (ENSMM), and the University of Technology of Belfort-Montbéliard (UTBM).
FEMTO-ST is an Institute which consists of 7 departments active in different fields of engineering science: mechanics, optics and telecommunications, electronics, time-frequency, energetics and fluidics, energy and electrical engineering, and computer sciences.
The PhD student will realize his thesis at the UTBM site in Belfort in the ENERGY Department of FEMTO-ST Institute. This department develops optimal design methodologies of electric hybrid systems, power converters and electrical actuators, real time control strategies of power converters and diagnosis of power sources.

Roberval : The Roberval Laboratory (research unit in mechanics, energy and electricity - FRE UTC-CNRS 2012) is positioning itself on the design of innovative mechanical / multiphysics components and systems, proposing to carry out scientific and technological research work in an interdisciplinary context, a necessary condition for designing, studying the behavior and durability of complex systems.
In particular, the Unit makes a substantive contribution to define a framework for studying these complex systems (choice between systemic or mechanistic approach, choice of scales relevant for the study of variability, ...).

Subject of the thesis:
The use of electric actuators is already almost universal in many areas such as automotive, aeronautics, home appliances, home automation and industry. It is still tending to increase due to the energy transition and the increase of the intelligent and the autonomy of the equipment. The objectives of energy efficiency, mechanical performance and comfort directly involve acting on the design of electric motors, their power supply and their mechanical environment that play an important role in the overall performance of the equipment. Optimizing the efficiency and power density of electrical machines and minimizing their cost of production is often to the detriment of performance such as torque pulsations, vibrations and acoustic emissions.

This thesis aims to design and validate methods of compensation of vibro-acoustic disturbances of electrical machines by action on the control of electrical quantities by exploiting an acoustic measurement. The modeling and control strategies will initially be applied to synchro-reluctant machines whose potential for competitiveness is important, but will then be extended to other technologies.

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