LABORATOIRE D'ELECTROTECHNIQUE ET D'ELECTRONIQUE DE PUISSANCE DE LILLE

Master Thesis Project, 2022-2023

INNOVATIVE MODELLING ANALYSIS OF ASYNCHRONOUS MACHINES

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General background

Asynchronous motors are key components of power generation plants. For a long time, the performance of these machines was analysed on the basis of real-life tests. Today, several calculation tools offer more or less sophisticated modelling.

Specific context of the internship

EDF R&D has a solid experience in the testing and analysis of asynchronous motors. EDF co-develops the electrical circuit software EMTP and the electromagnetic modelling tool code_Carmel for the study of electrical equipment. These approaches can be pooled to create models of asynchronous machines.
Thus, EDF R&D and L2EP have developed model reduction techniques that now provide a model halfway between the equivalent diagram in EMTP and the complete 3D finite element model. In addition, electromagnetic modelling is also a means of defining an advanced equivalent scheme and characterising it.

For any use of finite element modelling, a geometry and mesh input step is required prior to any calculation. The required data will be selected from the information already available at EDF R&D or at L2EP.
A first work is to be devoted to the modelling of locked-rotor asynchronous motors in Code_Carmel. In this phase, the geometry and nature of the materials are known. It will therefore be necessary to build the mesh model and establish a data set reproducing qualification tests for which measurements are available. The model will be validated by comparing the quantities of interest with the measurements.
The second part of the study is to be concerned with the characterisation of data for an electrical equivalent scheme. The work will then consist of performing a frequency sweep of the input voltage in locked rotor operation. The resulting Bode diagram will be used to identify the transfer function associated with the electrical scheme.
The third part of the activity will consist of formatting the results obtained previously. This will be done using models of the same asynchronous machine provided by EDF (standard EMTP model, reluctance network model, reduced model, finite element model). A report on the internship will be written, focusing on the modelling approach used, on the one hand, and, on the other hand, on the comparison with the other models provided.

Profile required

3rd year of engineering school, Master 2
Education : Electrical or numerical engineering
Skills: Electrical engineering, finite element calculations, Python language

Contact EDF

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