LABORATOIRE D'ÉLECTROTECHNIQUE ET D'ÉLECTRONIQUE DE PUISSANCE DE LILLE

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Electric machine models for sensorless control.

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Context

The study will focus on low power machines of Somfy Company and more specifically on a synchronous machine with permanents magnets.

For obvious economic reasons, the design of low power motors must incorporate many constraints such as low noise of electromagnetic origin, low manufacturing cost and sensorless control. In the case of this last goal; control of the machine while avoiding any sensor, a fast model is necessary which is used actually in the sensorless solution. Of course, depending of the control used, the model should be the well adapted to the control approach

Objectives

In the case of the aimed application, the supply is performed through trapezoidal voltage. Therefore, it is not easy to control the machine at load without any sensor. This is even much more difficult at standstill (N=0 rpm) due to the problem of detecting the position of the rotor.

The aim of the proposed study is to evaluate different solutions to eliminate any sensor while achieving an efficient control of the machine. Some solutions exist such as the detection of the third harmonic of the electromotive force or HF signal injection. However, this should be well used with the adapted model. The goal is then to develop different models and test them with different solution for sensorless control in order to determine the best combination Model/Control in terms of accuracy and robustness. The evaluation will be conducted using simulation tool (VSIM) link to a real test bench with the studied machine. When compared, the best solution will be implemented directly on the micro-controller to be tested and validated on the synchronous machine under study.

Different stages of work

1) Bibliographical synthesis (models for the sensorless control, micro-controller…).
2) List the different solutions with the advantages and disadvantages for the realization of sensorless control of the machine.
3) Define the analytical models with sensorless control and 2D finite element model in order to validate the impact for example of the third harmonic of electromotive forces "technic" for the studied machine.
4) Comparisons of the different solutions.

Reference

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