Study on permanent magnetic synchronous motor parameter identification based on its current signal

（課程博士・様式７）（Doctoral qualification by coursework,Form 7）

学 位 論 文 要 旨

Abstract of Doctoral Thesis

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論文題目：電流信号に着目した永久磁石同期モータのパラメータ同定に関する研究
Title of Thesis : Study on permanent magnetic synchronous motor parameter identification based on its current signal

論文要旨：
Abstract：

In recent years, interior permanent magnet (IPM) motors are widely used in a variety of industry, home appliance and automotive applications, owing to their high-efficiency and high-power-density features. The IPM motor is usually controlled by means of a field-orientation technique (vector control), and requires a current controller on the synchronous rotating reference frame (dq-reference-frame) for the instantaneous torque and the magnetic flux control. The current control on the dq-reference-frame mainly consists of the coordinate transformation, the PI regulation, and the decoupling compensation, which is based on the mathematical model of the motor. Therefore, it is indispensable not only to detect the magnetic-pole-position and the motor currents, but also to know the motor parameters accurately. Identification of the motor parameters is important to control the motor properly in starting up of the control as well as the running operation, and the off-line parameter identification is particularly required for the initial controller setup and starting up. There are four parameters to be identified off-line in the motor model, i.e., the q-axis inductance L_q, the d-axis inductance L_d, the magnetic flux linkage ψ, and the winding resistance R. Each of the motor parameters must be identified independently with as simple manner as possible.

This paper proposes a novel technique for home appliance to achieve the off-line identification of the IPM motor parameters and on-line identification of the IPM motor parameters, which requires only the motor current norm information. The proposed technique do not use the voltage signal, but uses the current information with several steps to complete the identification of all the parameters, where the current controller structure is changed every time the identification step proceeds.

The offline identification focusing on the minimum operation point of the current norm is sought by tuning the specific motor parameter until the parameter mismatch is cancelled out. The search for the current norm minimum point is achieved by an ordinary hill-climbing-algorithm with respect to the parameter mismatch. But the identification cost lot of time.

But the online identification focusing on the zero cross operation point of the current norm is sought by tuning the specific motor parameter until the parameter mismatch is cancelled out. The search for the current zero cross point is achieved by two point speculate algorithm with respect to the parameter mismatch. And the proposed identification method can finished the identification in hundreds millisecond.

In the following sections, some theoretical analyses are developed, followed by the simulation results, and then experimental test results are also presented to verify the proposed technique.

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