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Parametric identification of the doubly fed induction machine

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Abstract

Wind Energy is a very promising energy for the future. It is well known that the power delivered by wind turbines directly coupled to the grid is not constant as a result of the wind variability. In the absence of storage systems, a fluctuating power supply produced, can lead to voltage variations in the grid and flicker. Another disadvantage of most induction machines utilized in the wind turbines is that the required reactive power varies with wind speed and time. These problems can make the use of double fed induction generators attractive for wind turbine applications.
Doubly-fed induction machines (DFIMs) are beginning to dominate the wind generation market, particularly for the larger sizes of turbine. This work is dedicated to the identification of the parametric double-fed induction machine. We propose a model of the DFIG based on the method of vector space. This model is used to validate the experimental results of identified parameters of the machine. After considering several methods of parameter identification of induction machines, provided with the results of the experiments, we are particularly interested in standardized testing. The proposed approach allows determining the electrical parameters of the machine using conventional methods static and dynamic, mechanical parameters are estimated using a digital channel, following the curve of smoothed experimental slowdown. The identified model parameters are verified by comparing their simulated stator and rotor currents responses against the measured currents. It is again observed that the estimated model responses match the measured responses well.

Keywords: wind generator; doubly fed Induction machine; Modeling; parameters Identification.

1. Introduction

Wind energy is being developed as a result of environmental problems posed by the conventional energy sources and the technological progress of wind turbines. This type of energy on the electrical network is increasingly importance in the windy areas. As a result, impact on the electricity grid, the quality of the power produced by wind turbines increases [1]. Currently the majority of wind power projects based on

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the use of double-fed induction machine. DFIG has the distinction of having two three-phase windings in stator and rotor. Using a power converter controlled by PWM to control the speed of rotation of the DFIG. This device allows the variable speed operation of DFIG and has the advantage of using a low power converter (30% of rated power supplies to the network) [2].

2. Double-fed induction generator (DFIG)

The wound rotor of the DFIG machine is usually three phase and it is housed in slots, the end of each phase is connected to a ring which is fixed on the brush rubs. This allows access to the rotor to change specifications, to connect to an assembly of power electronics such [3].

2.1. Wind systems using the DFIG

Wind turbines with variable speed electronic coupling to the rotor in Figure 1 are connected to the network by a DFIG (wound rotor). The coupling between the generator and AeroTurbine is through a mechanical speed multiplier. The stator winding is connected directly to the network and transfer the bulk of power, a power converter controlled by PWM allows varying the rotor currents of the DFIG excitation. It is important to know the parameters of the DFIG accurately, so that the control is optimal, hence the importance of identifying parametric of DFIG [4].

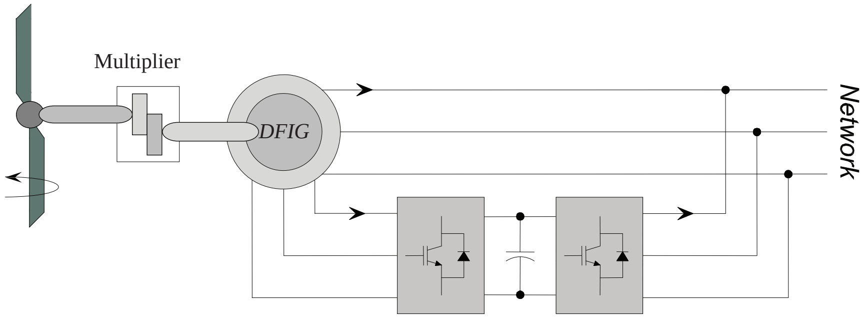

Fig. 1. Wind system based of DFIG with rotor electronic coupling.

3. Modeling of double-fed induction machine

3.1. Vector space Expression of the stator and rotor flux

The windings of the stator and rotor are represented symbolically in Figure 2. [5]

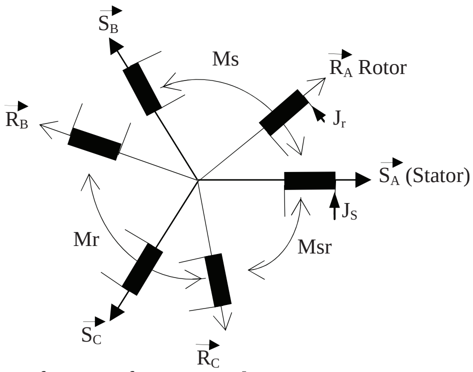

Fig.2. Definition of various inductances.