Wind-Energy Science, Technology, and Research
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Diagnosis of Electrical Faults of Wind Turbine DFIGs

Principal Investigator:
Siavash Pakdelian, University of Massachusetts Lowell

Co-Principal Investigators:
Murat Inalpolat, University of Massachusetts Lowell
Babak Fahimi, University of Texas Dallas

Student Researcher:
Ehsan Qiyassi, University of Massachusetts Lowell

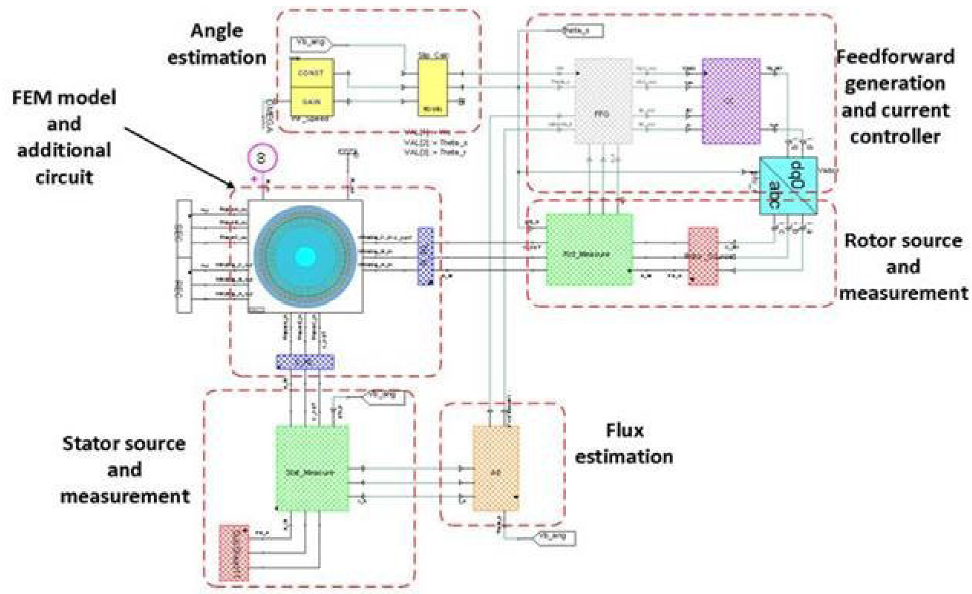
IAB Mentors:
Veronica Hernandez, Bachmann Electronic Corp
Paul Haberlein, Pattern Energy

During the first quarter of the project, two different models for the analysis of a wind turbine system were developed. The first model is an ideal model implemented in MATLAB/Simulink and the second model is a numerical one to be analyzed with finite element method. At the first step, these models were verified with the parameters drawn from experimental tests performed at UT Dallas. All of the models are based on given specifications of this machine which is a 10 HP DFIG.

The Finite Element Model (FEM) of the machine was connected to an external controller implemented in Simplorer, which is a multi-physic environment compatible with our FEM. Since the Finite Element Analysis (FEA) is a very time-consuming process, the controller was implemented in a way to be able to test the speed of the simulations both with the discrete and continuous solver. Simulations were configured with the continuous solver settings that yield a good accuracy and the best simulation speed time.

Even though some of the faults and non-idealities being studied could be implemented outside the FEM, other faults such as dynamic eccentricity of the rotor and stator and rotor short circuit faults would be best implemented using the FEM, which was carried out next. Different methods for implementation of stator and rotor short circuit fault were tried, and the ones that produce the most stable and fastest simulations were executed. Processing the results using Fast Fourier Transform (FFT) confirms that operation of the current controller masks all the known fault signatures in the rotor and stator current. However, our findings indicate that voltage and current space vector and two control voltage vectors in the synchronous reference frame could be used to identify the fault.

The main focus of this study is on the rotor asymmetry and stator and rotor inter-turn short circuit faults. For each of the faults, various simulations are carried out to identify the fault signatures and the severity of the fault that could be detected. This choice is made based on the frequency of the occurrence of these faults. However, since rotor asymmetry alone comprises more than half of the generator failures, special attention has been paid to studying the effect of other practical non-idealities of the operation field and generator conditions, such as grid voltage unbalance and eccentricity.



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