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IMPROVEMENT IN DOUBLY FED INDUCTON GENERATOR UNDER FAULT USING INDUCTOR

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ABSTRACT

This project concentrates on the Low Voltage Ride Through (LVRT) capability of Doubly Fed Induction Generator (DFIG) wind turbine. The main attention in the project is, to the ability to protect itself without disconnection during grid faults, when the fault occurs the line voltage or current becomes 8 times to the normal rating, which can damage the converter which are connected to the rotor side. For this we are using an inductor for the protection of over voltage and currents, which is carried out in Matlab/Simulink, which reduces the over voltage and current during fault. 3-phase inductance is connected in series with the stator terminals.

***Keywords: DFIG,* Grid Stability, Wind Turbine Technology.**

I.INTRODUCTON

As wind power begins to represent a greater proportion of total generation capacity, wind farms are having greater influence over power system behaviour. In this scenario, wind farms are required to contribute to the stability of the system, including the key issue of fault-ride-through (FRT), which refers to the capability of generation plant to remain connected, dynamically stable, and offer network support throughout a serious voltage disturbance on the transmission network. Although the voltage dips associated with grid faults may last for only a few cycles, they can bring about certain undesirable characteristics of induction-machine generators In the past, wind turbine generators were disconnected fromthe system during faults . Nowadays, there is an increasingrequirement for wind farms to remain connected to the powersystem during faults, since the wind power lost might affect

the system stability Therefore, the wind turbine behaviour during system performance and its influence in the system protection must be analyzed. One of the most frequent irrelevant features about integratingwind energy into the electricity network is that it is treated inisolation. An electricity system in practice is modify like amassive bath tub, with hundreds of taps providing the input and millions of plug holes draining the output. The taps and plugs are opening and closing at all the time. For the grid operators, the task is to make sure there is enough water in the tub to maintain system security. It is therefore the combined effects of all technologies, as well as the demand patterns, that matters. The specific nature of wind power as a distributed and variable generation source requires specific infrastructure investments and the implementation of new technology and grid management concepts. High levels of wind energy in system can impact on grid stability, congestion management and transmission efficiency and transmission adequacy. A grid code covers all material technical aspects relating to connections to, and the operation and use of, a country's electricity transmission system. They lay down rules which define the ways in which generating stations connecting to the system must operate in order to maintain grid stability.

II. DOUBLY-FED INDUCTION GENERATOR

The wind turbine and the doubly-fed induction generator(WTDFIG) are shown in the figure\. The AC/DC/AC converter is divided into two components shown as rotor-side converter (Crotor) and grid-side converter (Cgrid). Crotor and Cgrid are Voltage-Sourced Converters that use forced commutated power electronic devices (IGBTs) to synthesize an AC voltage from a DC voltage source. A capacitor connected on the DC side acts as the DC voltage source. A coupling inductor L is used to connect Cgrid to the grid. The three-phase rotor winding is connected to Crotor by slip rings and brushes and the three-phase stator winding is directly connected to the grid. The power captured by the wind turbine is converted into electrical power by the induction generator and it is transmitted to the grid by the stator and the rotor windings.

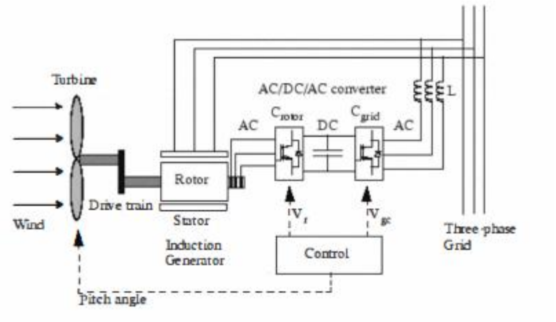

Figure 1. Operating Principle of the Wind Turbine Doubly-Fed Induction Generator

III.INDUCTANCES FOR REDUCING TRANSIENTS

A 3-phase inductance, equal to magnitude of DFIG self inductance, is inserted at stator terminals for a time equivalent to time taken to reach steady state. It is then disconnected using a timer switch, since its pertinent existence affects the generator performance. The effect of inserting these inductances is investigated at sharp wind speed variation. Connecting inductances to stator terminals where the stator self inductance Ls is replaced by Ls + L_{ext}., where L_{ext} is the proposed added external inductance.

The applied external inductances, reduced the stator and rotor currents and voltage to nearly steady state value, as shown in Figs. 3 and 4 and not only improvement in transient of stator and rotor current but along with this we got an improved power factor at the time of simulation of the system power factor is improved as shown in Fig. 5 (steady state p.f. value = 0.92), when compared to Fig.2, which demonstrates the system power factor without inductances(steady state p.f. value = 0.575).

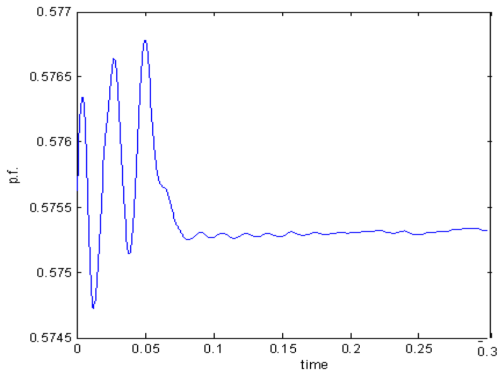

Figure. 2. System power factor.

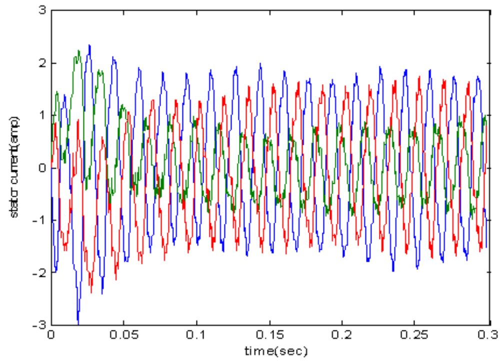

Figure. 3. Stator current at abrupt wind speed variation with inductances.

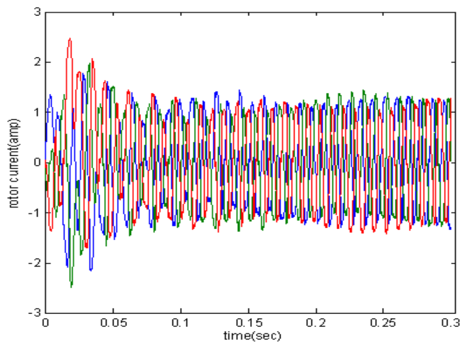

Figure.4. Rotor current at abrupt wind speed variation with inductances

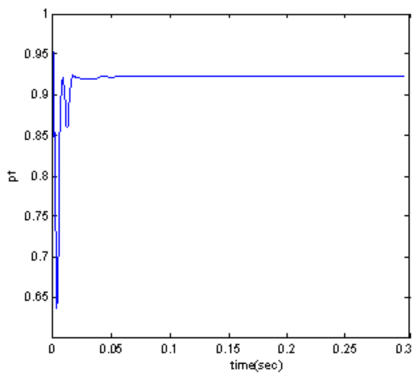

Figure. 5. System p.f. with Inductances.

IV.EXPERIMENTAL SETUP

The 9MW wind farm is connected to a 25 kV network, via a 66 KV/440V transformer. The transformer is rated 12 MV A. A resistive load of 500kw is connected at the wind farm. A high pass capacitor filter is used, the DFIG wind farm is connected to the 120 kV network through a 30 km 66 kV line and a 120/125 kV transformer.

V.CONCLUSION

The series reactor protects the flow of high rotor current and stator current both in grid and wind farm itself. During fault the impedance of the grid and wind farm becomes very low by inserting series reactor in the grid side converter it lowers the value of fault current in grid and wind farm.

REFERANCE

[I] J B. Ekanayake, L. Holdsworth, X G. Wu, N. Jenkins, "Dynamic Modeling of Doubly Fed Induction Generator Wind Turbines," IEEETransaction on Power Systems, Vol. 18.No. 2, May 2003, pp. 803 -809.

[2] J G. Slootweg, H. Polinder, W L.Kling, "Dynamic Modeling of a Wind Turbine with Doubly Fed Induction Generator " Proc. of 2001 IEEE Power Engineering Society Summer Meeting, Vol. I, pp. 644 - 649.

[3] L. Holdsworth, X G. Wu; 1. B. Ekanayake, N. Jenkins: "Comparison of fixed speed and doubly-fed induction wind turbines during power system disturbances" lEE Proceedings - Generation, Transmission and Distribution, Volume: ISO, Issue: 3, 13 May 2003, pp. 343 - 352.

[4] A Tapia, G. Tapia, J.X Ostolaza, J. R. Saenz: "Modeling and control of a wind turbine driven doubly fed induction generator" IEEE Transactions on Energy Conversion, Volume: 18, Issue: 2, June 2003, pp. 194 - 204.

[5] R. Koessler, S Pillutla, L. Trinh, D. Dickmander: "Integration of large wind farms into utility grids (Part I - Modeling of DFlG)", Proc. Of 2003 IEEE PES General Meeting.

[6] M. H. J Bollen, M. Martins, G. Olguin, "Voltage dips at the terminals of wind-power installations," presented at the Nordic Wind Power Conference 2004, 1-2 March 2004, Chalmers University of Technology, Goteborg, Sweden.

[7] F. Runcos, R. Carlson, A M. Oliveira, P Kuo-Peng, N. Sadowski, "Performance Analysis of a Brushless Double Fed Cage Induction Generator," presented at the Nordic Wind Power Conference 2004, 1-2 March 2004, Chalmers University of Technology, GOteborg, Sweden.

[8] J Niiranen, "Voltage Dip Ride Through of Doubly-fed Generator Equipped with Active Crowbar, " presented at the Nordic Wind Power Conference 2004, 1-2 March 2004, Chalmers University of Technology, Goteborg, Sweden.

[9] MATLAB Sim Power Systems User's Guide, Version 4.6 (R2008a), http://www.mathworks.com/access/helpdesk/help/toolbox/physmod/powersysl

[10] Akhmatov V., "Induction Generators for Wind Power", Multi-Science Publishing Company, Ltd., 2005.

[11] EOLE Program 2010, "http://www.edfcom",2010.

[12] 0 Aluko, T.M Smith,L.M Tolbert, "Behavior of DFIG Under Nearby Wind Plant Fault", IEEE Publishing Company, Ltd., 20 10.

[13] Ling PENG "Reconfiguration du dispositif de commanded' uneeolienneen cas de creux de tension" These SoutenueIe 17/06/ 2010 L2EP LlLLE.