

Impact of Doubly Fed Wind Generators on Electrical Power System during Balanced Faults in Transmission Network

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Abstract

Today worldwide distributed generation (DG) takes a very important role in the operation of distributed electric power systems. However, the existence of distributed generation may have impacts on different topics, such as fault currents, fault protection, coordination schemes or fault location. If there is short-circuit in the system, the presence of one or more distributed generators can affect the fault current levels, the monitoring of voltages and currents at the substation. The main supply generation will not have to inject as much power to the line because of the DG and, therefore, voltages and currents at the substation will be different from the ones that would be measured without DG .

In this paper, an analytical study of a network that consists of 9 knots and contains three generators, which are connected to the voltage level 230kV through step-up voltage transformers. In addition, the mentioned network supplies different loads.

This study includes a simulation of the network using ETAP program, in the normal operation (power flow), and then some fault cases are simulated. The impact of the faults on the network parameters, and the impact of adding a wind generator on one of the network bus-bars are studied. The study focused on changing the fault current when we add the wind generator.

In addition, the paper shows the benefits that we can get from of adding the generator, e.g. improvement of the main network voltages during the faults. .

Finally, the effects of changing the rated power of the generator and the connection point on the network parameter were studied.

Keywords: fault analysis, fault current, transmission network, distributed generation, ETAP program.

For the abstract in Arabic see pages (353-367).

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References:

- Kala Meah, Member, IEEE, and A.H.M. Sadrul Ula, Senior Member, IEEE " Simulation Study of the CIGRE HVDC Benchmark Model with the WSCC Nine-bus Power System Network ".
- Alpay Özcan, Member, IEEE, and Heinz Schättler,"A Computational Method for the Calculation of the Feasibility Boundary and Clustering in Differential-Algebraic Systems", SEPTEMBER 2005.
- Natthaphob Nimpitiwan, Student Member, IEEE, and Gerald T. Heydt, Fellow, IEEE Department of Electrical Engineering, Arizona State University: "Fault Current Issues for Market Driven Power Systems with Distributed Generation", June 2005.
- Natthaphob Nimpitiwan Gerald Heydt: "Consequences of Fault Currents Contributed by Distributed Generation", Power Systems Engineering Research Center, June 2006.
- Ali Keyhani : "Integration of Green Energy in Distributed Generation Systems", Professor of Electrical and computer Engineering Ohio State University, Columbus Ohio.
- Ali Hamza, Department of Electrical Power Engineering Branch of Renewable Energy, Damascus University, "Integration of Distributed Generation Into Electrical Distribution Systems", 2010-2011.
- Method of short circuit calculation in ETAP program.
- Data from the National Energy Research Centre (NERC) 2011.
- Ali Hamza, Hassan Alsweidan, Department of Electrical Power Engineering, Damascus University, "Coordination and automation systems in Electrical power systems", 2008-2009.