STUDYING THE EFFECTS OF DIFFERENT WIND FARM TOPOLOGIES ON SWITCHING OVER VOLTAGES

By

Ahmed Ragab Abd El Aziz Aly

A Thesis Submitted to the
Faculty of Engineering at Cairo University
in Partial Fulfillment of the
Requirements for the Degree Of
MASTER of Science
in

Electrical Power and Machines Engineering

FACULTY OF ENGINEERING, CAIRO UNIVERSITY
GIZA, EGYPT
2017

Summary:

Switching processes are frequently repeated in wind farms which may cause destructive over-voltages to the wind turbines components. This problem becomes prominent in almost all wind farms. This thesis establishes a transient frequency-dependent model using DIGSILENT software to simulate switching actions in a real wind farm (ZAFRANA wind farm in Egypt). The main purpose of this work is to show the effect of the different wind farm topologies on the value of the transient over-voltage peak. The radial design of ZAFRANA wind farm is firstly simulated under different energizing events. The topology is then changed to be a single side ring, double sided ring and star topologies. Simulations under the same switching conditions are simulated and analyzed in each topology. The over-voltages are measured in each case across the wind turbines transformers. The results show that the radial topology shows the highest over-voltages among all topologies, transformers in the single sided ring and double-sided ring topologies suffer less transient over-voltage compared to that in radial and star topologies. A new switching methodology is suggested in the radial topology to maintain the radial design benefits over the over-voltage problem. The proposed splitting switching of radial feeder reduces the over-voltage level to a value can be mitigated by the existing protective devices.