Fayoum University
Faculty of Engineering
Electrical Engineering Department
Division of Electrical power and machines

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WIND TURBINE EMULATOR
DESIGN AND IMPLEMENTATION

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ABSTRACT

Over the last two decades, there has been a large penetration of renewable energy generation into the power supply network. Among the available renewable energy resources; wind energy is one of the best and fastest growing renewable energy sources. The main component of wind energy conversion system is the wind turbine. Because it is difficult to examine the steady state and dynamic performance of a wind energy conversion system without the dependence on natural wind resources and real wind turbine, an emulator system for wind turbine is designed to emulate the wind turbine features for the purpose of research.

The wind-turbine-emulator (WTE) is defined as an active system for analysis and developing the stored energy with the wind to electrical conversion systems. In this thesis, A WTE has been built using a separately excited DC machine. The DC motor is coupled to a self-excited induction generator (SEIG) to represent an isolated wind energy conversion system (WECS). The system is controlled by a PI controller. The wind turbine separately excited DC-motor and the SEIG connected to excitation capacitors and load have been simulated on Matlab/Simulink platform. The proposed control approach is implemented on a dSPACEMicrolabBox, model DS1202 and Matlab/Simulink real-time control programming. The performance of the system has been studied through the simulation and verified experimentally. Many operation cases have been studied such as loading, no load and at different wind speed command.