WESEP 502X. Wind Energy Systems

Laboratory Activities

WESEP 502X will include several hands-on experiences, which may include simulation, operation, and analysis of physical systems commonly encountered in wind energy conversion systems. These activities are designed to reinforce topics covered in lecture, and will require a level of participation that enhances your educational experience. Some activities may have pre- or post-lab homework assignments.

Activity details can be found in the Wind Energy Systems Experimenter’s Handbook; a work in progress. The corresponding experiments are listed in parenthesis.

Lab activities will take place in the Wind Energy Systems Lab, located in 1102 Coover Hall. Observe all safety requirements associated with these activities, summarized in another document provided with these course materials.

**Week(s) Topic Activity**

1-2 Elect. Machines & Power Converters Inspection/operation of several machine types (exp 3.1)

1-2 Elect. Machines & Power Converters Steady-state operation of a DFIG (exp 3.2)

3 Grid Integration Inspection of B2B converter and components (exp 4.1 and 10.1)

3-4 Wind Turbine Control DFIG with B2B converter demonstration (exp 4.1)

6-7 Tower Structures & Construction Turbine Inspection and Tower load measurements (exp 6.1)

8 Sensing and Inspection Extract gearbox health from measured shaft torque (exp 7.2 or 7.3)

9 Turbine installation, operation, & maint. Operate the wind turbine at specific conditions (exp 1.2)

11 Economics Estimates from wind forecasts or historical data (exp 2.1)

11 Economics Effect of Yaw control on power production (exp 8.1 and 8.2)

In addition to the above activities, you are encouraged to use the tools and resources available in the lab for your course project.

**Resources:** **Project Ideas:**

DC Power Supplies Buck converter for synchronous generator control

Oscilloscopes Back-to-Back converter for DFIG control

Signal Analyzer Full-bridge converter for PMSG control

Signal Generator Pitch control system

Power Electronic Circuits Signal analysis for health monitoring

Microcontrollers Wind speed and direction measurement for siting study

Programmable Load Reactive Power and grid support capabilities

 Blade loading analysis

 Tower loading analysis

 Gearbox vibration analysis

Note, in Fall 2015, did three activities in WESEP 502 1) intro to power electronics and operation of a simple converter (GSC) 2) Blade force measurement to find best pitch angle 3) Vibration analysis from hub imbalance.

For WESEP 512, did blade force and pitch angle, tower force and vibration with speed and angle, and hub imbalance.