

# DFIG/Wind Turbine Modeling and Protection

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## Design Review #1

### Team Power Team

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## Itinerary:

1. Our understanding of project goals
  - a. Parameterize DFIG
  - b. Build RSCAD model
    - i. Implement Mike Beacham's control for DFIG
    - ii. Include micro-grid
  - c. Detect one type of fault
  - d. Protection scheme for transmission system
2. Current project standing
  - a. Base transmission system model utilizing canned DFIG
  - b. Working runtime model with multiple fault types and locations
    - i. Button operated faults
  - c. Parameterized DFIG
  - d. Project research
    - i. DFIG protection problems
    - ii. 411 and 421
    - iii. RSCAD learning
3. Questions for Normann
  - a. Transmission line model length?
  - b. Type of fault?
    - i. SLG is most common but 3ph seems to be easier to work with.
  - c. Are there components that need to be added or taken away from model?
  - d. Can we utilize existing 411, 421, or 311 to look at line current differential?
    - i. Normann's preference?
  - e. What does done look like?
    - i. Specific deliverables
    - ii. Time specifications for detection and protection
      1. We are eyeing 2 Cycle detection. Is this a realistic number?
    - iii. Information relevant to project?
      1. Insight?
      2. SEL Contacts?

# DFIG Project Specifications

1. Customer needs a protection scheme
  - a. Verification of pre-designed model
  - b. Fault analysis on DFIG connected to model power grid
  - c. Use existing technology to detect and protect against a single fault
  - d. Verify protection scheme

Specific Requirement	Description	Target	Acceptable Performance
Model Verification <i>waveforms</i> <i>↳ How far off after 2 cycles of</i>	Receipt of pre-designed wind turbine simulation to be verified by comparison to known results	Model behavior matches that of known examples	Same
Fault Analysis of DFIG <i>fault</i>	Analysis of current, voltage, and duration of DFIG under fault conditions	Behavior matches known fault conditions	Same
Detect a fault	A scheme to detect a single type of fault (TBD) while fault is occurring	Detection within 2 cycles (Preliminary)	Detection within 4 cycles <i>within 1 cycle - 1 1/2 cycles</i>
Equipment protection	Power system protection following detection	Within 4 cycle of detection	Within 10 cycles of detections
Protection Verification	Compare modeled protection scheme to scheme demonstrated physically on model power system with DFIG	Parameters within a standard deviation	Parameters within two standard deviations
Existing technology	Use of off the shelf SEL equipment to detect and protect faults	Using equipment already in lab	SEL donations of needed equipment

- 411 L

- Lowest voltage = faulted phase

↳ Single LG fault

Action	Deadline
<b>Parameterization of DFIG Machine</b>	October 30, 2014
<b>Begin modeling model power system in RSCAD</b>	Mid November
<b>Determine type of fault to be analyzed</b>	December 8, 2014
<b>Come up with preliminary design for protection scheme</b>	January
<b>Begin protection simulation testing</b>	February
<b>Have "black box" representation of protection scheme</b>	May

## Generator Parameters









