GE Wind Turbine Reliability Analytics

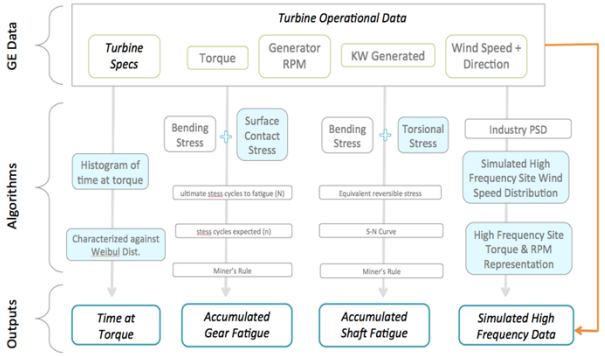
Semester Objective

- Generate lifetime consumption estimations
  - Wind Turbine drive train components
  - From field monitoring data
- Develop fatigue based metrics

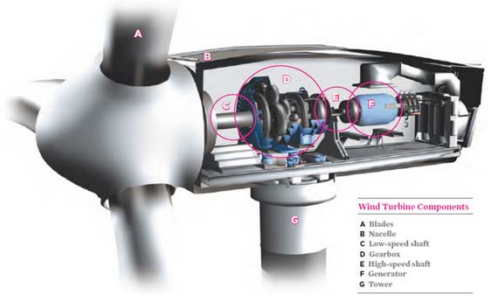
Project Plan

- ✓ Understand last semester's approach and assumptions and propose improvements
- ✓ Develop set of algorithms with
  - Improved shaft model
  - Improved gear model
  - Time at torque metric
  - Simulated high frequency data
- ✓ Rank turbines based on results
- ✓ Benchmark against expected wind conditions

Project Overview

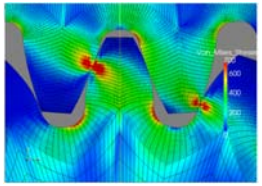


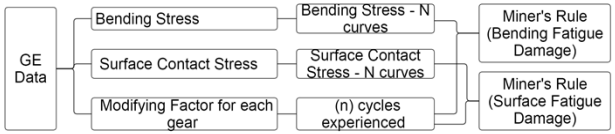
Gear Box Drive Train Analysis



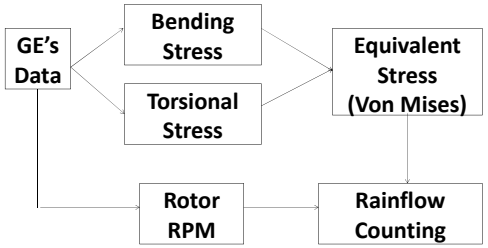
Gear Box Analysis

1. Helical Gears.
2. Analysis of Each Gear.
3. Bending and Surface Contact Stresses.

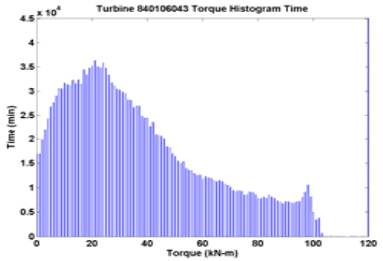


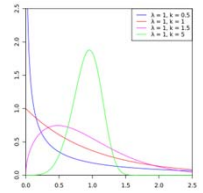


Main Shaft Analysis



Time at Torque

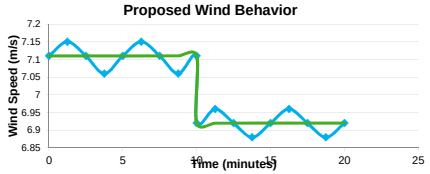




- Standard Weibull distributions
- Time at Torque histogram showing cumulative torque loading for a single turbine.

Simulated High Frequency Data

10 Minutes Averages → Refined Cyclic Model



Results

Low speed shaft will not fatigue

Gear tooth fatigue is a sensitive indicator of gearbox life

Time at torque can be used to rank overall turbine life