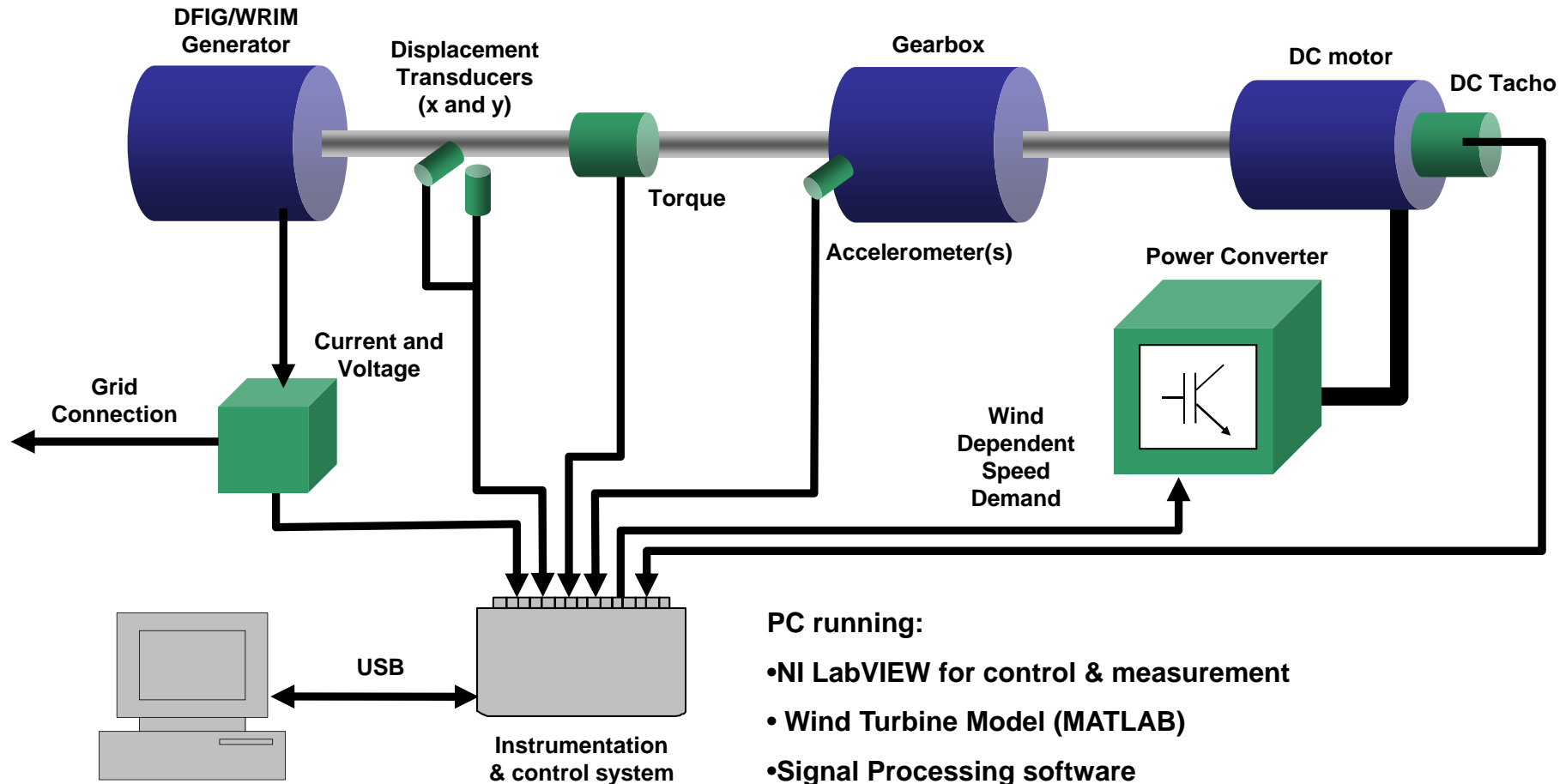


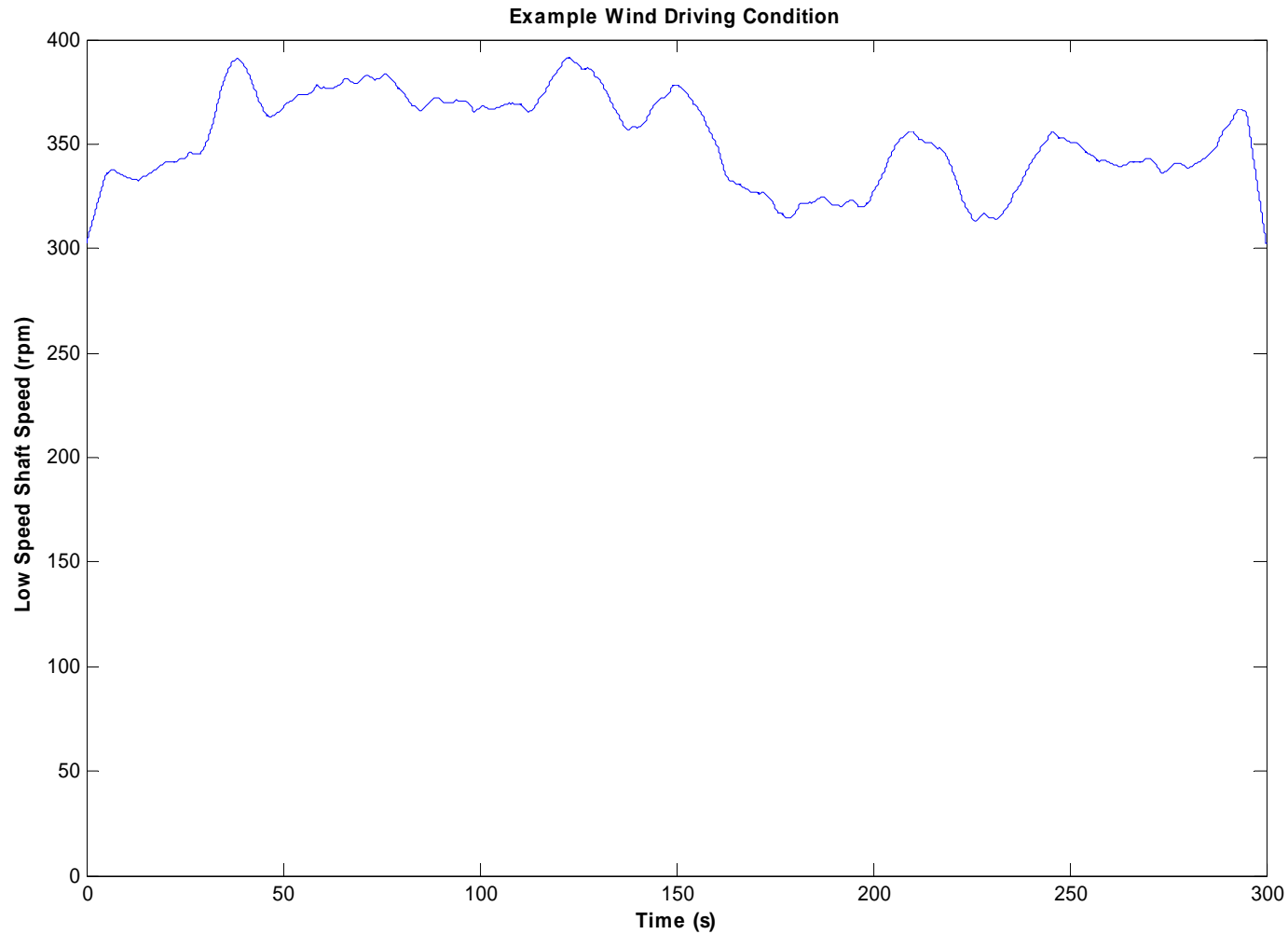
Durham University Condition Monitoring Test Rig

Current Status of Condition Monitoring Test Rig Research
Prof. Peter Tavner, Dr Yang Wenxian , Chris Crabtree
11th March 2008

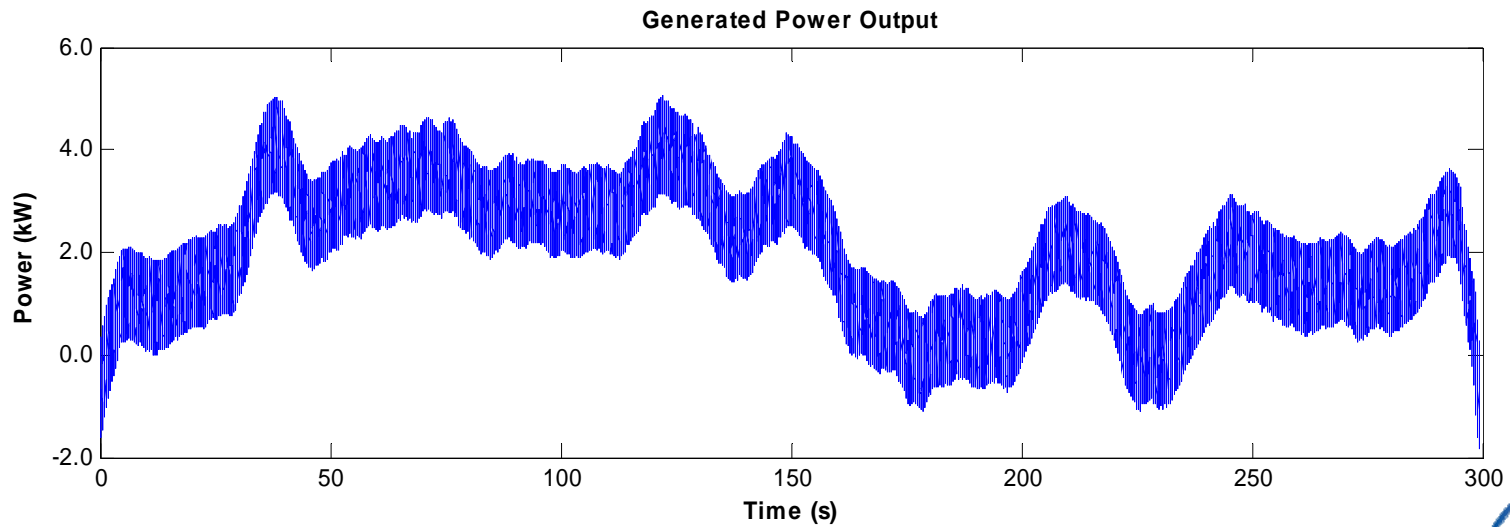
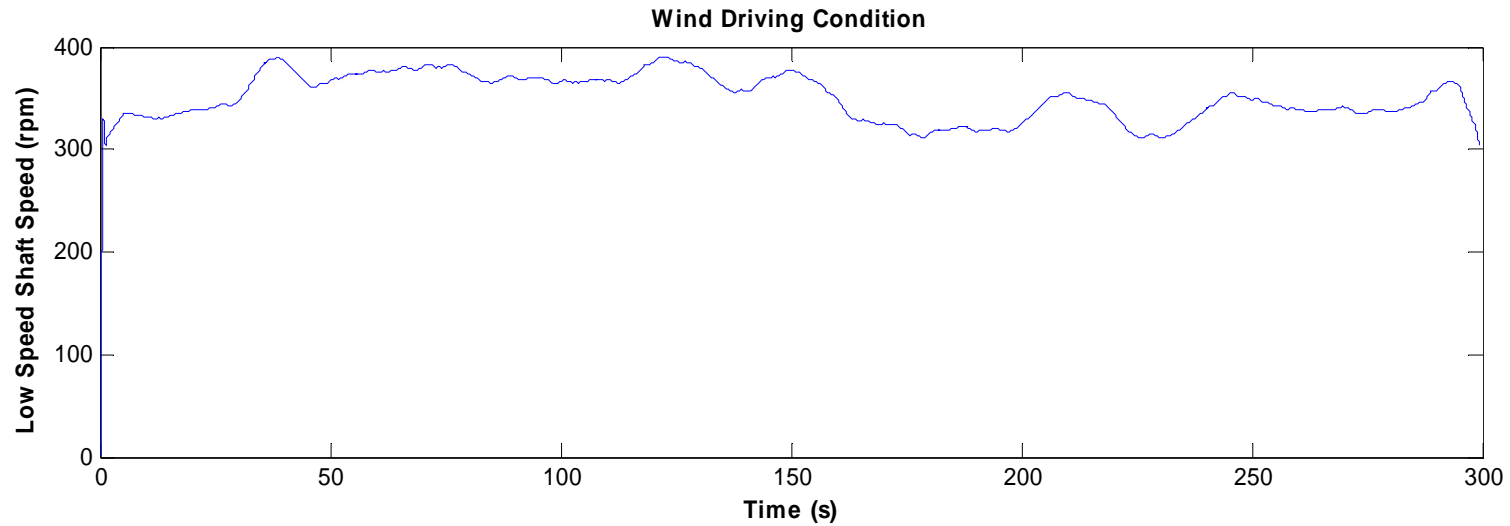
Layout of Drive Train



Wind Driving Conditions

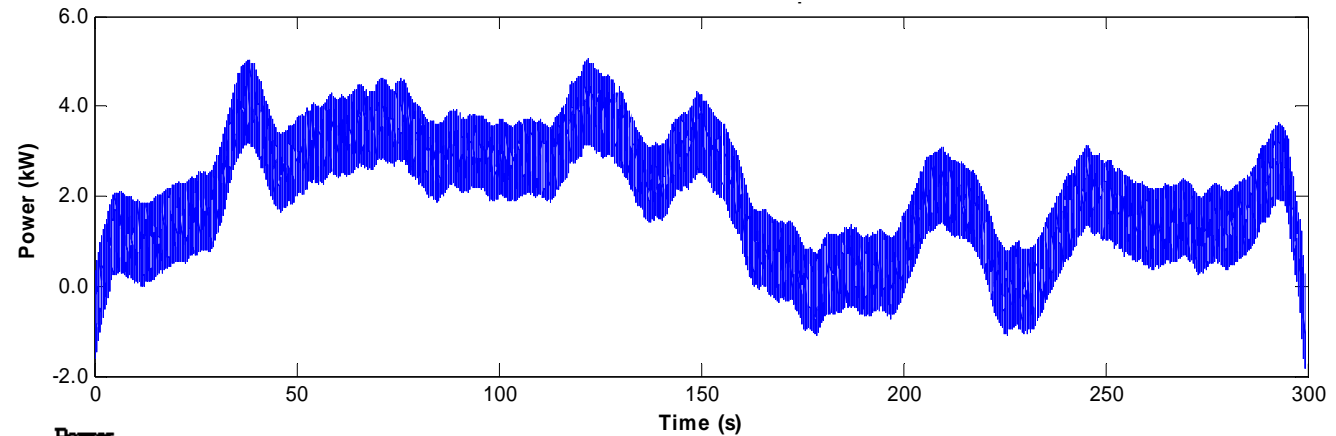


Example of Power Output

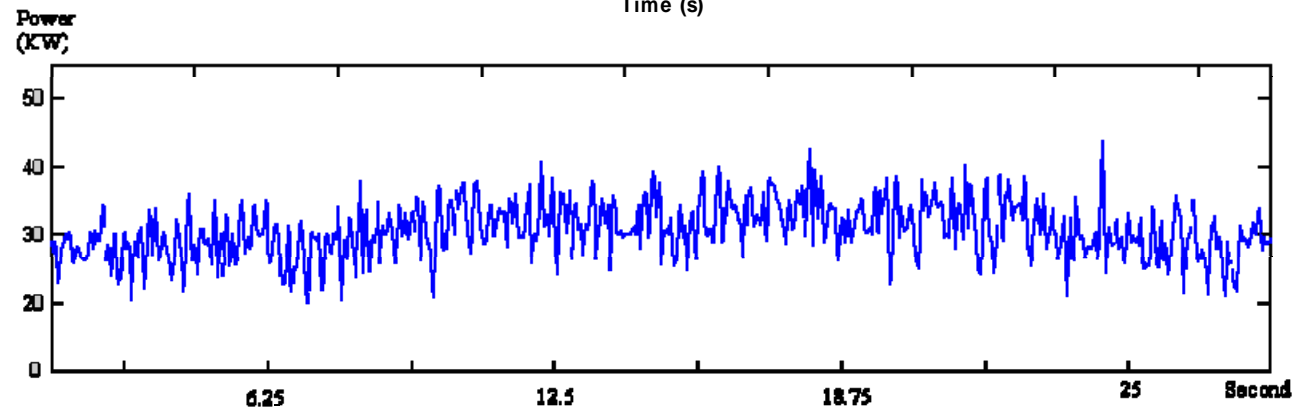


Comparison with Real Power Data

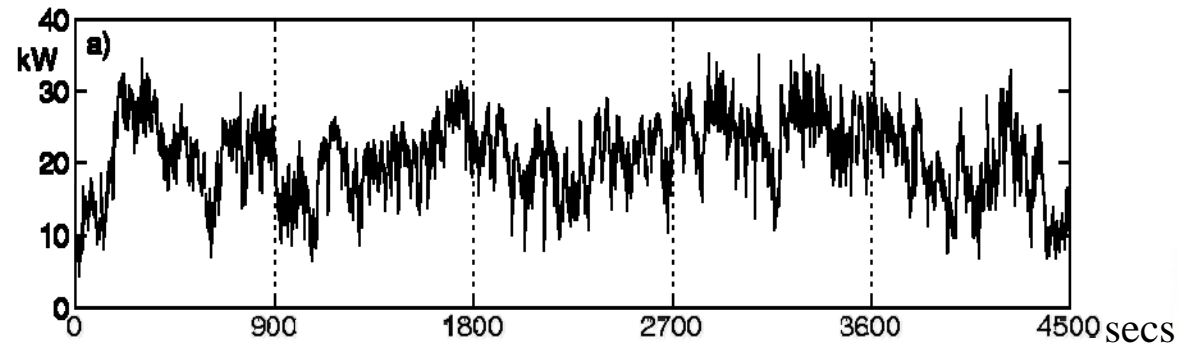
Power Signal from
Durham Test Rig



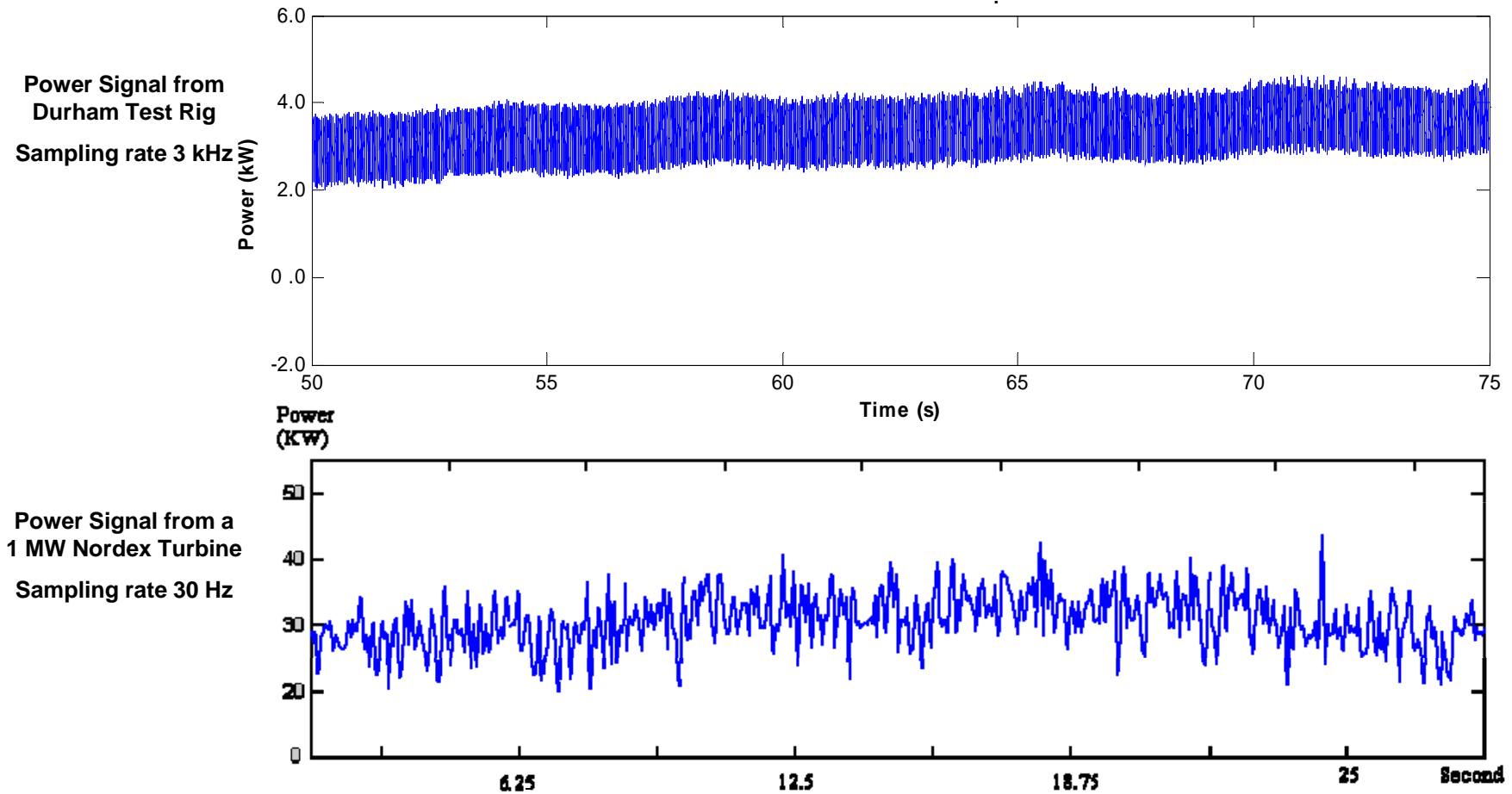
Power Signal from a
1 MW Nordex Turbine



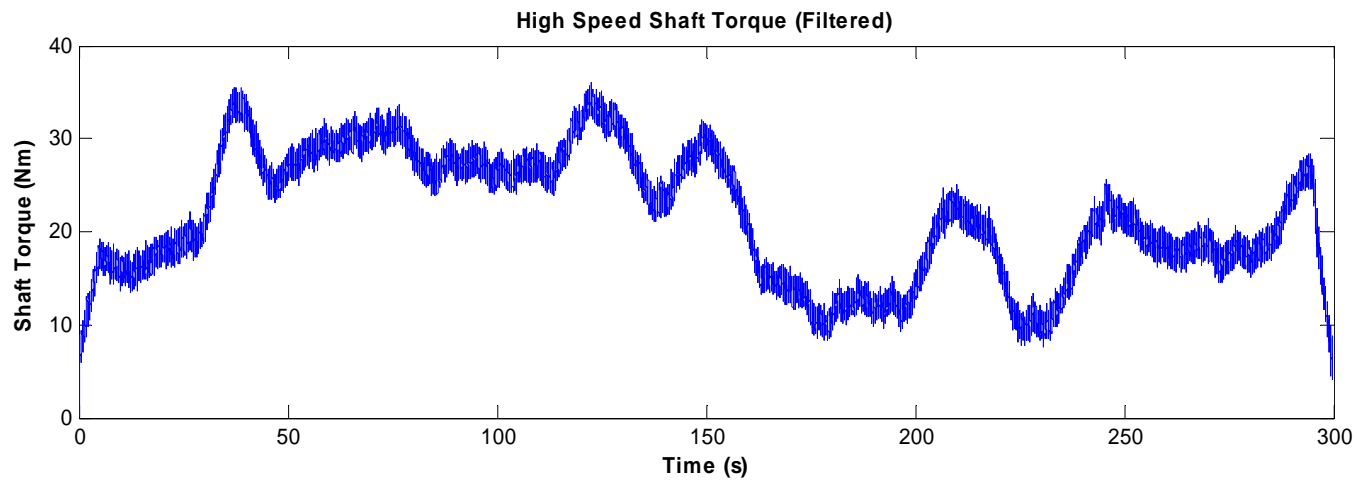
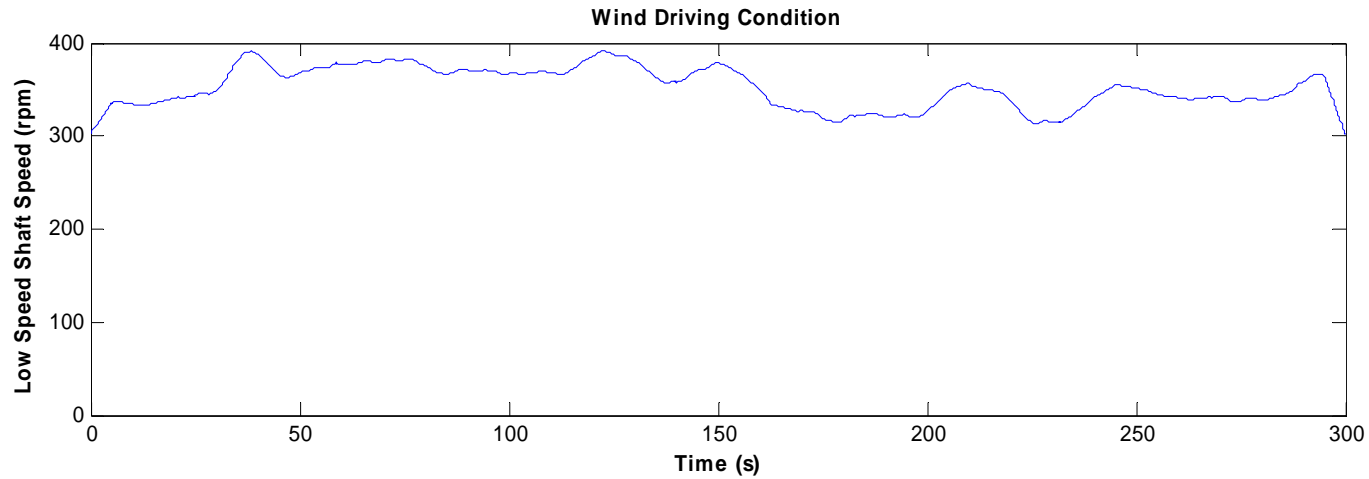
Power Data from a
33 kW Aeroman Turbine



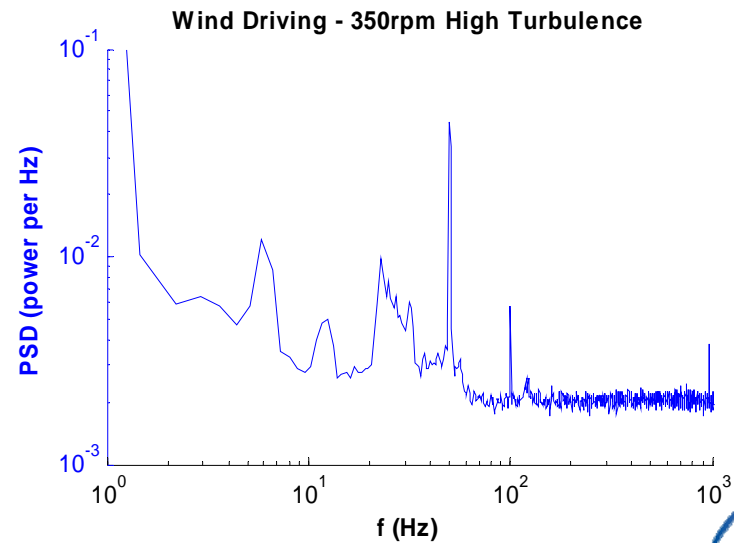
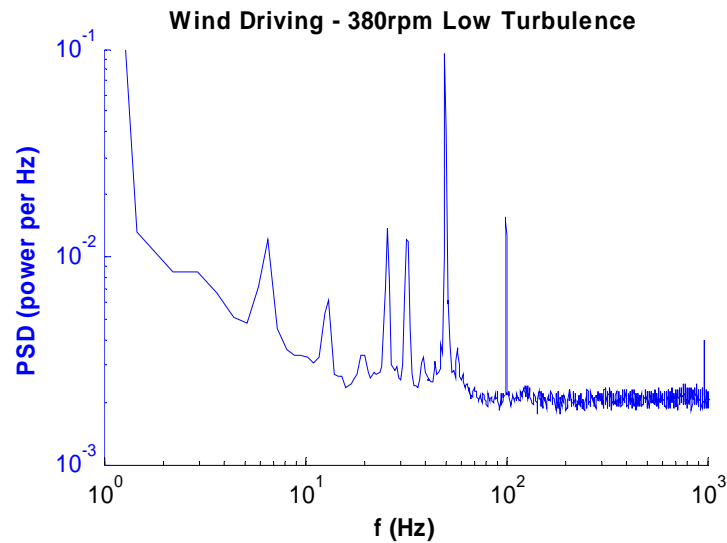
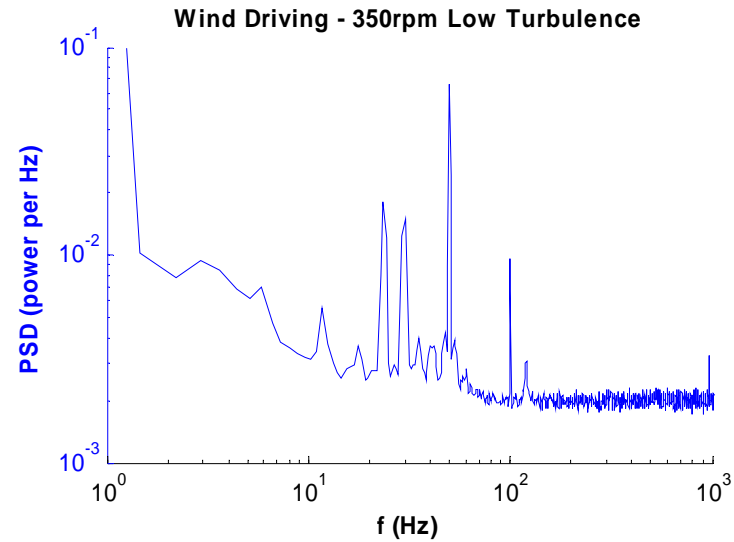
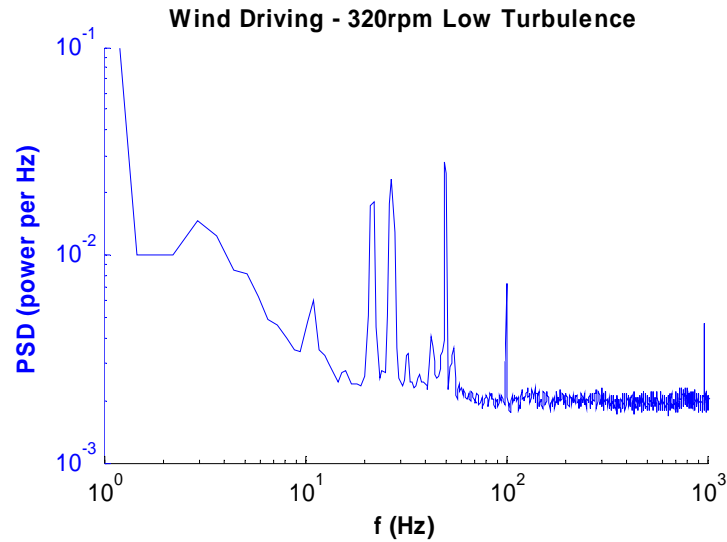
Comparison with Real Power Data



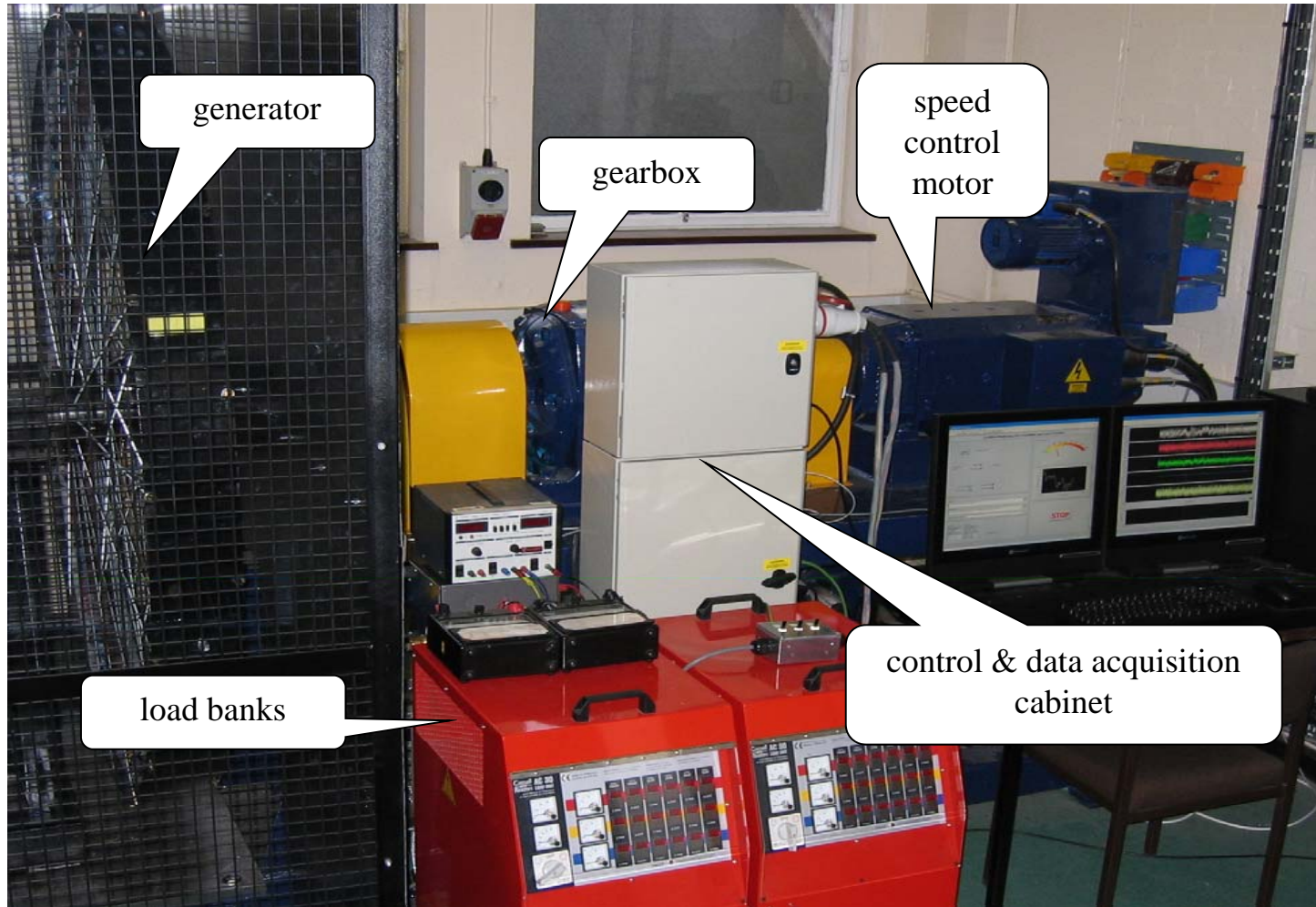
Example of Torque Output



Torsional PSD of Test Rig, currently

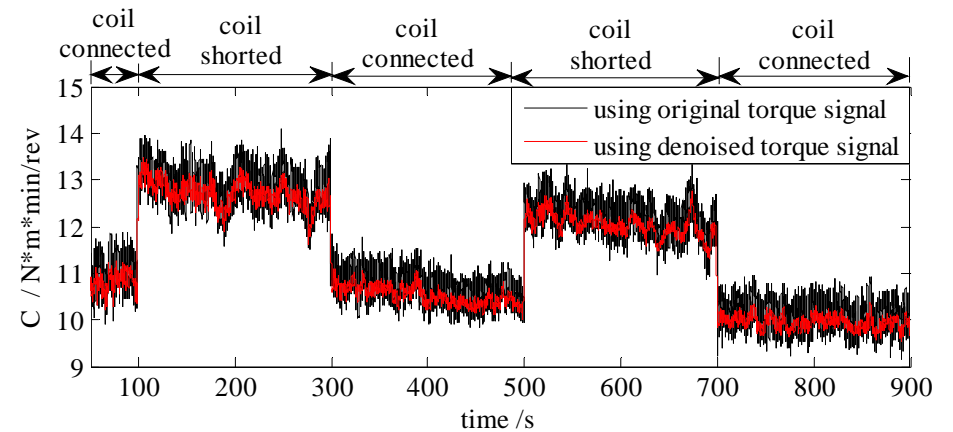
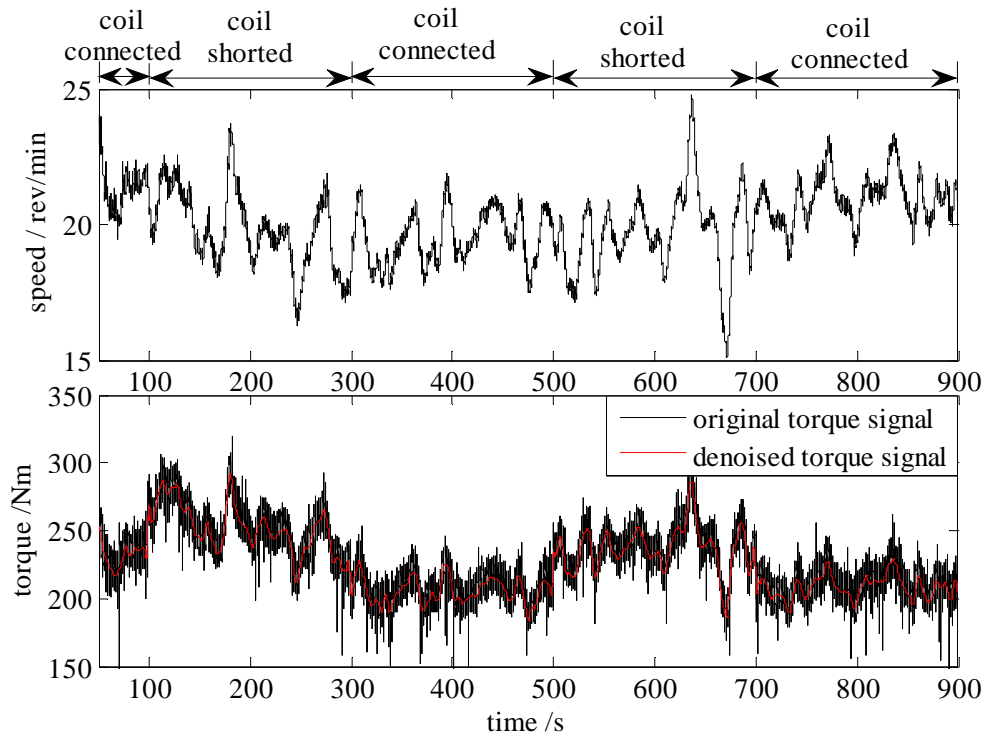
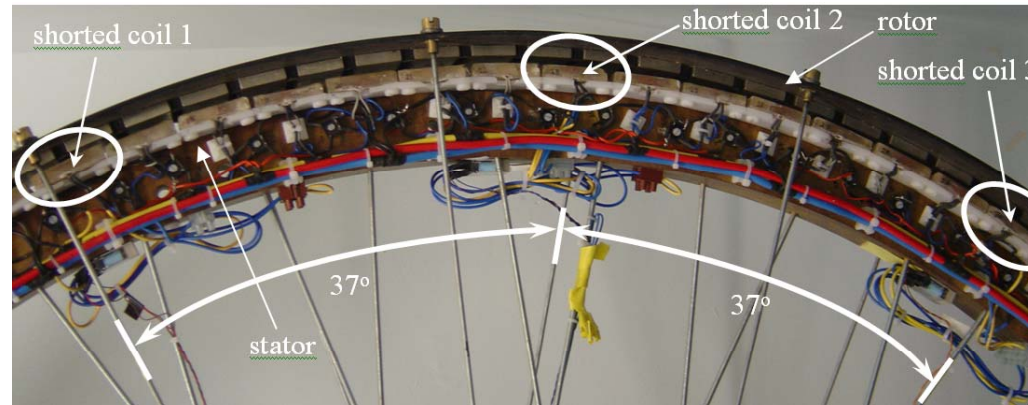


SLiM Test Rig





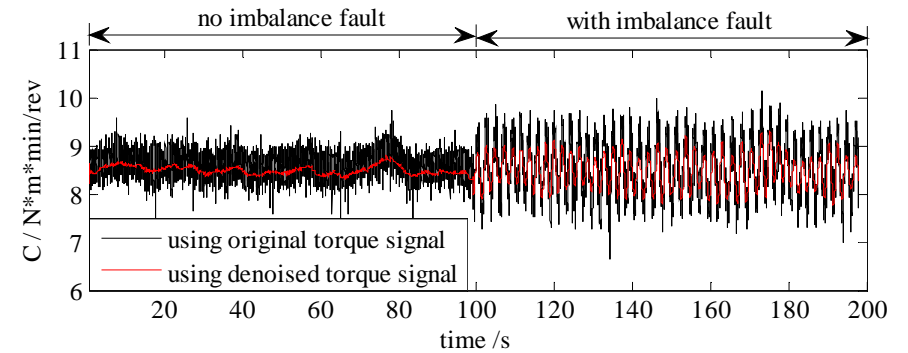
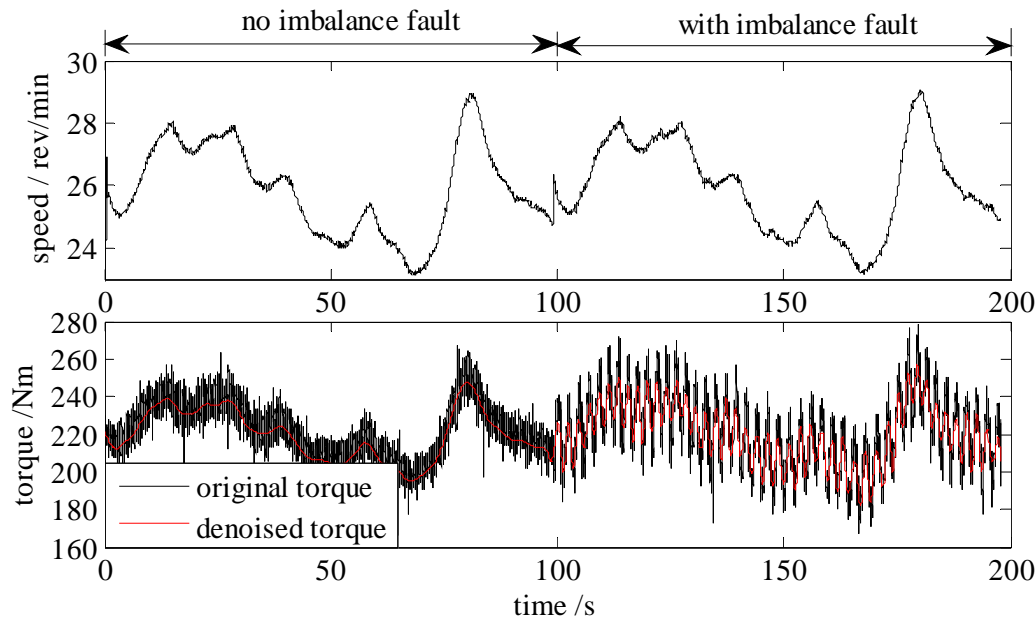
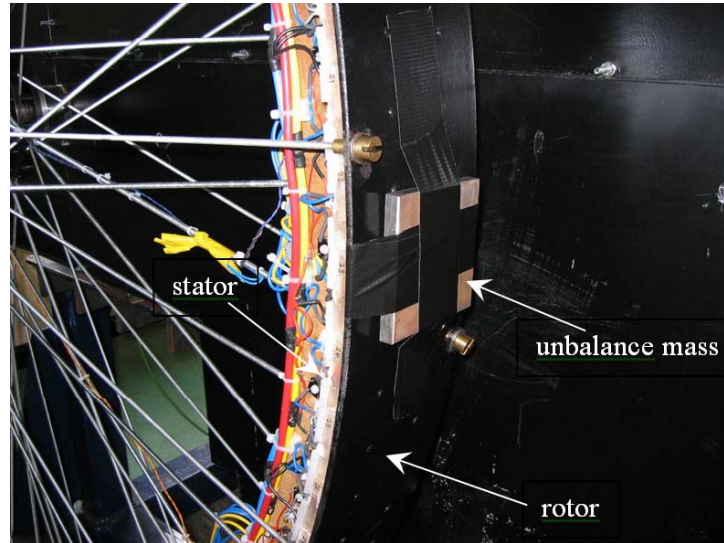
Condition Monitoring-Stator Winding Fault



----- Experiments on SLiM Test Rig -----



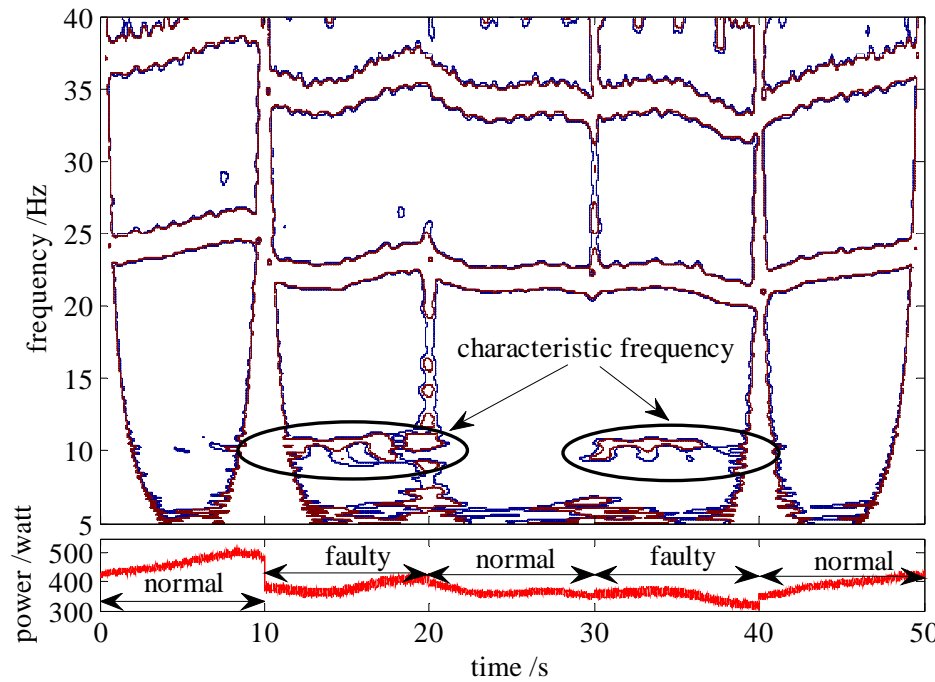
Condition Monitoring-Rotor Unbalance



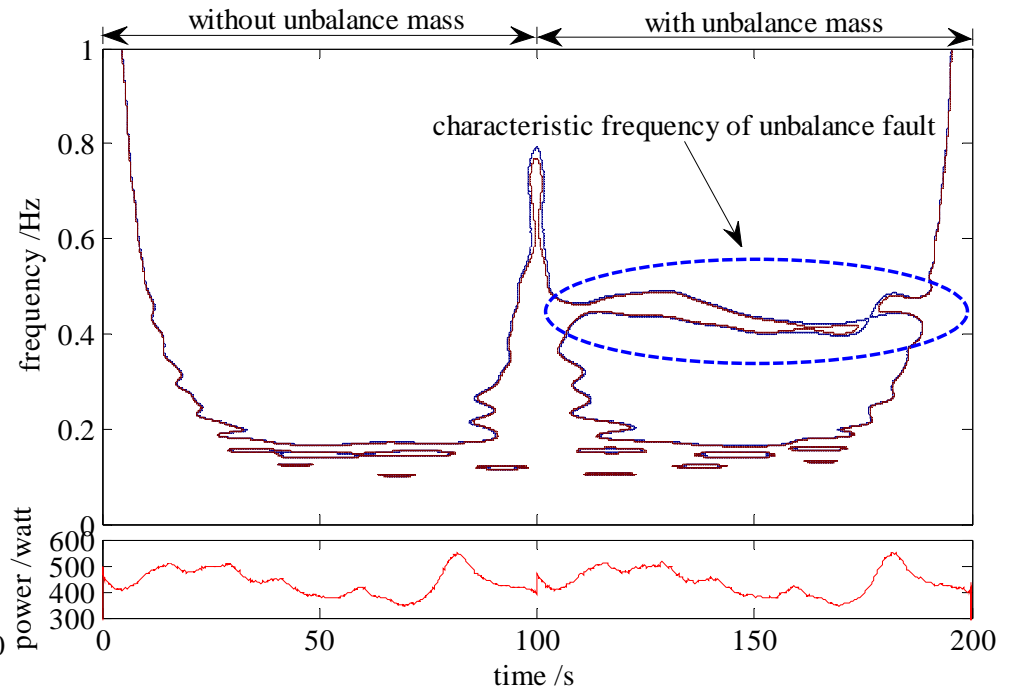
----- Experiments on SLiM Test Rig -----

Fault Diagnosis by Power Signal Analysis

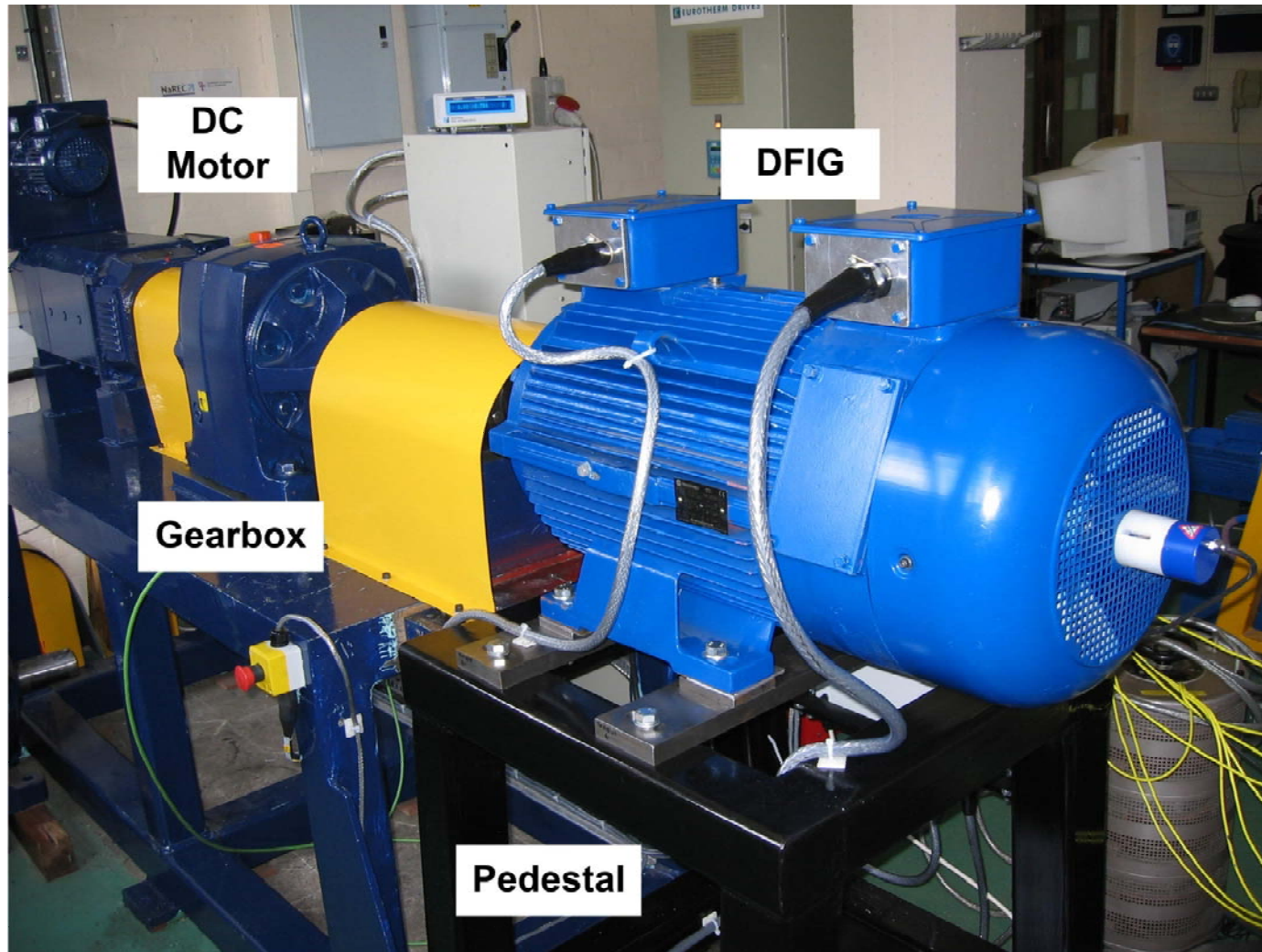
Stator Winding Fault



Rotor Imbalance Fault

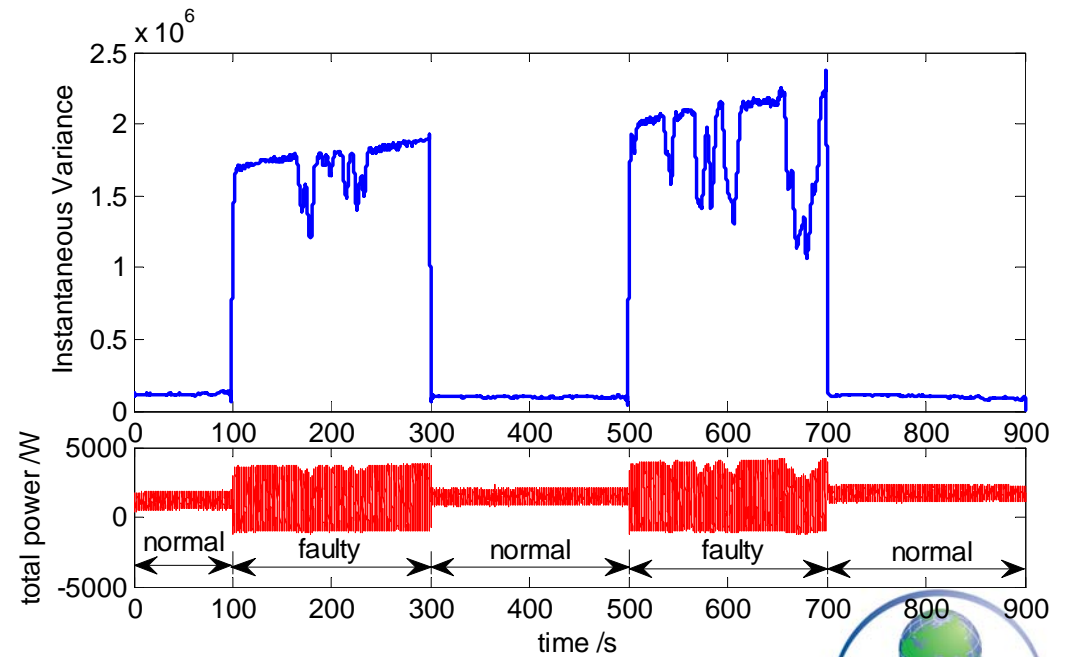
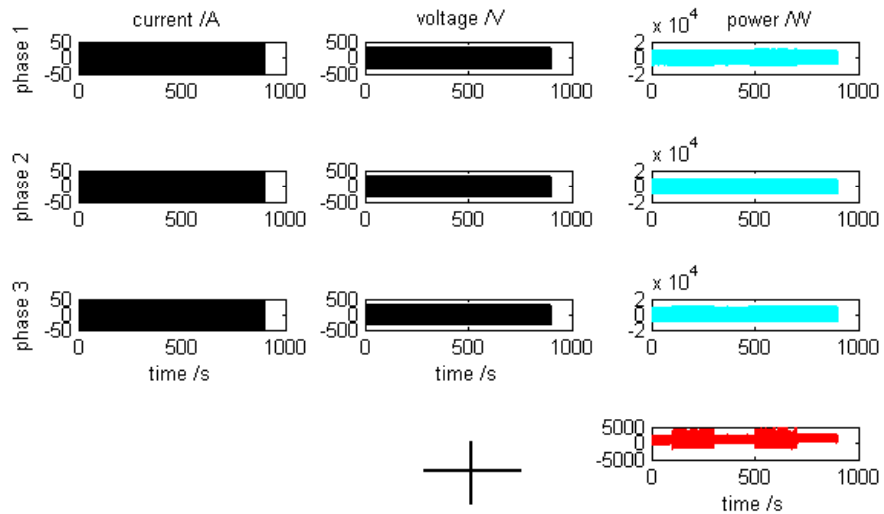


DFIG Test Rig



----- Experiments on DFIG Test Rig -----

Condition Monitoring-Rotor Imbalance

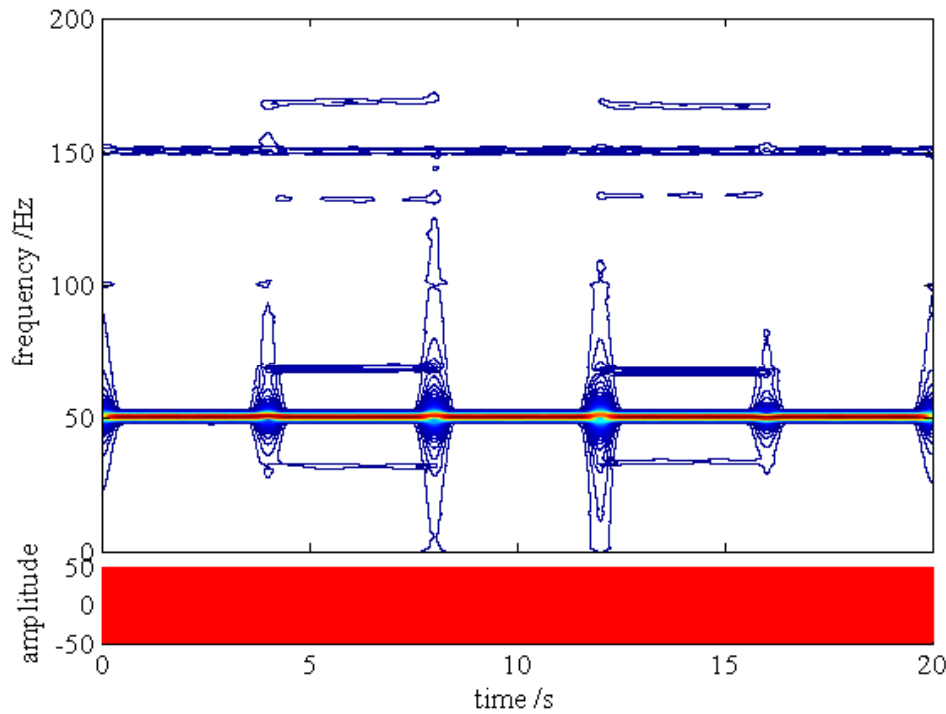


----- Experiments on DFIG Test Rig -----

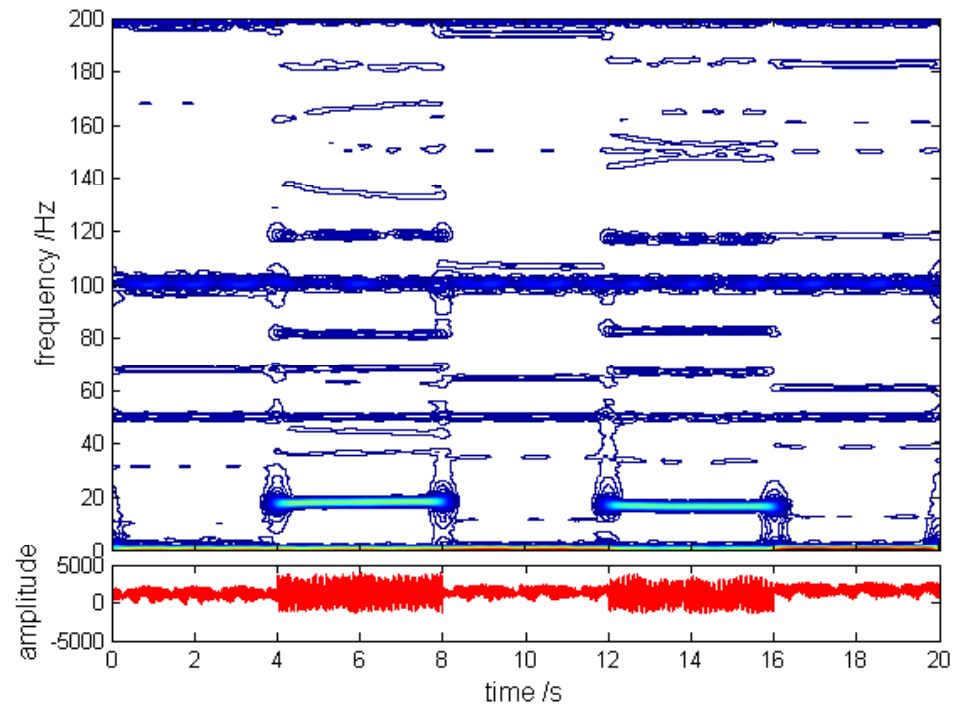
Fault Diagnosis-Rotor Imbalance

---- Using Gearbox with Gear Ratio 11.14:1 ----

Phase Current signal



Total Power Signal

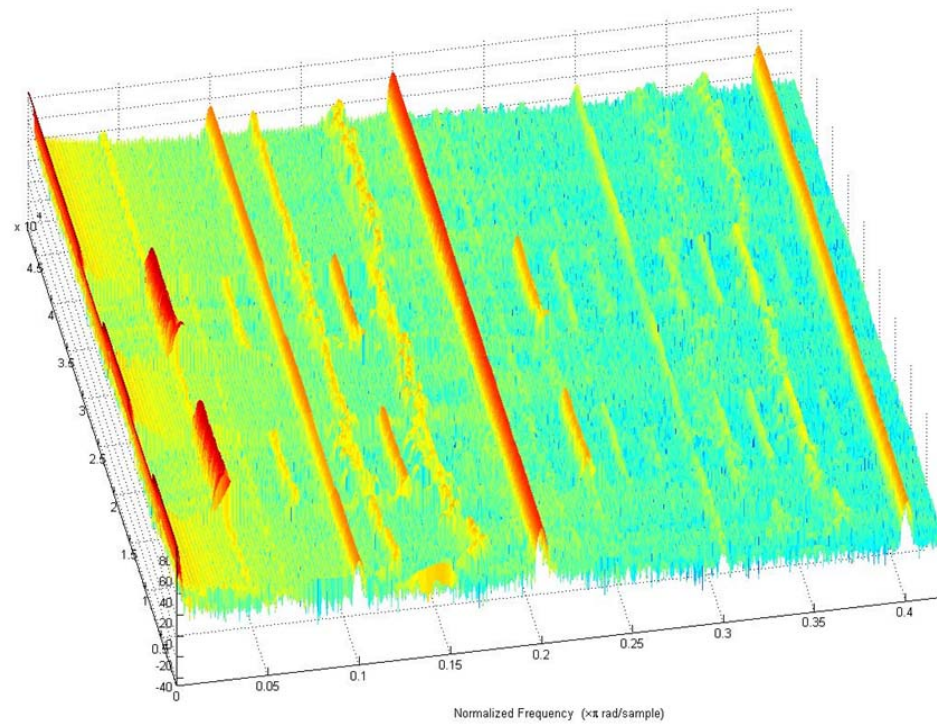


----- Experiments on DFIG Test Rig -----

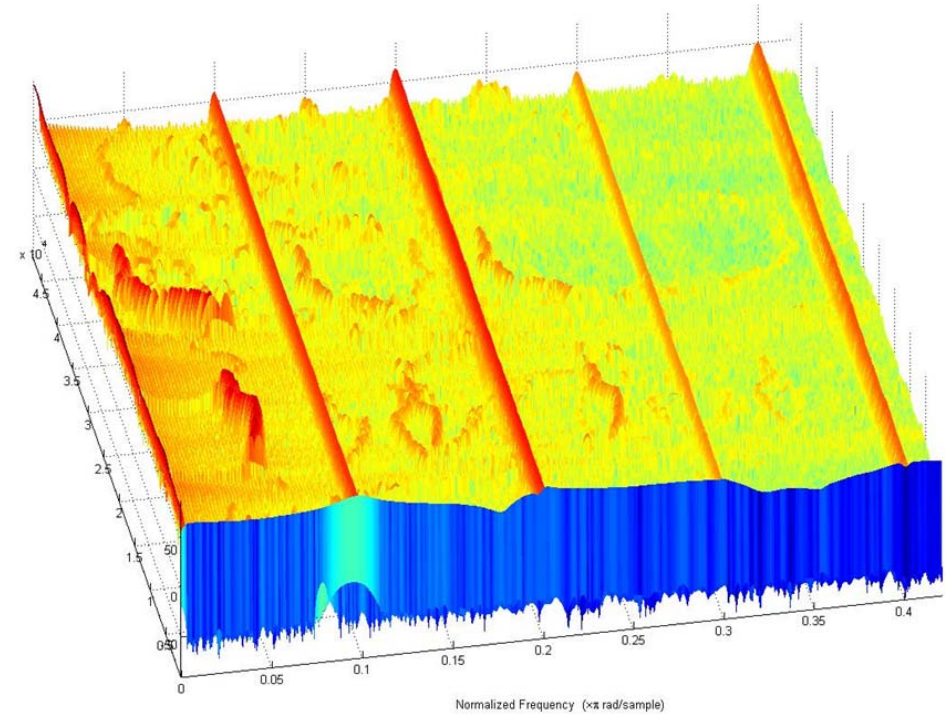
Fault Diagnosis- Rotor Imbalance

---- Using Gearbox with Gear Ratio 5:1 ----

Constant Wind Speed Data



Wind-driven Speed Data



----- Experiments on DFIG Test Rig -----

Thank you

- Tavner P J, Edwards C, Brinkman A, Spinato F. Influence of wind speed on wind turbine reliability. *Wind Engineering*, 30(1), 2006.
- Tavner P J, Xiang J, Spinato F. Reliability analysis for wind turbines. *Wind Energy*, 10(1), 2007.
- Spinato F, Tavner P J, van Bussel G J W, Reliability of Wind Turbines and their Subassemblies-In particular Gearboxes, Generators and Converters. *Proceedings of IET Renewable Power Generation*, under review.
- Wilkinson, M R., Spinato, F., Knowles, M. and Tavner, P. J, Towards the Zero Maintenance Wind Turbine, Presented at 41st Universities Power Engineering Conference, Northumbria University, September 2006, 5pp.
- Wilkinson, M R, Spinato, F, Tavner, P J, Condition monitoring of generators & other subassemblies in wind turbine drive trains. *IEEE Int Conf SDEMPED, Cracow, Sept 2007*
- Yang W X, Tavner P J, Wilkinson M R, Condition monitoring and fault diagnosis of a wind turbine synchronous generator drive train, *Proceedings of IET Renewable Power Generation*, under review.