Internship proposal for master students or engineer students

**Evaluation of wind turbine SCADA-based condition monitoring methods on real data recorded from a French wind farm**

Supervisors : S. Charbonnier, C. Berenguer  
(Sylvie.Charbonnier@gipsa-lab.grenoble-inp.fr, christophe.berenguer@gipsa-lab.grenoble-inp.fr)

The important growth in the wind power sector has led to the development of larger wind turbines (WT), which are located into remote area. The importance of reducing any downtime coming from unexpected failures has then become critical. To do so, Condition Monitoring techniques (CM) have been developed using at first dedicated systems using raw vibration signals. The signals have to be acquired via added systems which can be expensive and working independently from the WT PLC control system. In order to reduce the cost, research now focuses on the use of low frequency data coming from SCADA (Supervisory Control and Data Acquisition) systems.

The SCADA provides low frequency data (data every 10 minutes) from all the sensors as well as alarms used for emergency action. SCADA data possess significant advantages if being applied to WT CM. For example, SCADA systems have been installed in the majority of MW-scale WTs. No more hardware investment is needed when developing a SCADA-based CMS. So, it will be cheap in cost. However, WT SCADA data are usually 10 min average data. The conventional machine CM techniques (e.g. spectral analysis) cannot be applied to interpreting them. WT SCADA system was not initially designed for CM purpose. It does not collect all the information needed for conducting a full CM of a WT. Developing condition monitoring tools for WT using SCADA data is thus not self-evident and it has become a fast growing research field.

The aim of this internship is to implement several SCADA-based WT CM methods recently proposed in the literature, as well as more general data-driven process monitoring methods, and to evaluate their performances on a real data-base. The data-base is made of SCADA data recorded during several years on 6 different WTs from a French wind farm. The main production, control and environmental variables - such as speeds, temperatures, powers … - are monitored for each turbine of the farm. To validate the methods, periods when no faults occurred on the WTs and periods when WTs were in faulty conditions have already been selected. The data are provided by the French society VALEMO, located in Bègles (33), which is a subsidiary of Valorem in charge of the exploitation and maintenance of renewable energy power plants.

S. Joe Qin Survey on data-driven industrial process monitoring and diagnosis, Annual reviews in control, Volume 36, Issue 2, December 2012, Pages 220–234

Wenxian Yang, Richard Court, Jiesheng Jiang, Wind turbine condition monitoring by the approach of SCADA data analysis, Renewable Energy Volume 53, May 2013, Pages 365–376


Kusiak A., Li W., The prediction and diagnosis of wind turbine faults Renewable Energy 2011 36 16-23


Zhang Z., Comparison of Data-driven and Model Based Methodologies of Wind Turbine Fault Detection with SCADA Date, EWEA March 2014