IPID4all Doctorate Research Exchange with University of Oviedo
Feedback report

Luis Vera-Tudela

ForWind

http://www.forwind.de/forwind/index.php

Prof. Martin Kühn

17th July – 13th October

Implementation of a load monitoring system in a wind farm

University of Oviedo

Metrology and models

http://di002.edv.uniovi.es/~luciano/metrologia.html

Prof. Luciano Sanchez

Introduction

Extending the lifetime of wind turbines is relevant to increase the financial return of wind farms. As wind turbines are sized taking into account their expected fatigue loads, which are calculated with physical models, monitoring fatigue loads during their operational life is desired. Monitoring fatigue loads is expected to improve strategies related to O&M and lifetime extension projects; but the direct measurement of loads is both costly and complex. However, since most commercial wind turbines are monitored via Supervisory Control and Data Acquisition (SCADA) systems, my research focuses on estimate fatigue loads from 10-minute statistics of SCADA data. The most relevant outcome is to describe a methodology to build a data-driven model that relates them for a given wind turbine. The major challenge is, once the model is completed, to maintain the model estimation quality when it is deployed to other turbines in a wind farm.

Research Undertaken

Estimations with uncertain information and modelling with data mining techniques are core competences at the Metrology and Models group of the Oviedo University.

During the stay we took three paths:

1. With an eye on short-term results, we focused on the challenges that appear when the research is implemented in a commercial wind farm. Results will be presented at the Wind Europe Conference, next November.
2. To assure a common ground for future cooperation, colleagues reviewed the documentation of my research, to later discuss with me the methodology as well as algorithm implementation issues. Their advice was a clear and benefitial, so they were incorporated in my dissertation.
3. With an eye on long-term cooperation, we explored two lines for future research: interval predictions and isotonic regression as alternative models to relate SCADA data and fatigue loads. Results from isotonic regression is being documented for submission to the Journal Applied Soft Computing.

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Personal Experience

The 3 months living in Spain were a wonderful familiar experience. Something we had in our plans long time ago. Apart from the professional gain obtained from the interaction with researchers in machine learning, it was very enriching personal experience to recognise and live first hand the large similarities and subtle differences in traditions and lifestyles.

Conclusions

The overall results from the exchange were by far positive, in both professional and personal terms, and were not limited to my stay. Apart from the impact in my PhD, we organised cooperation for future scientific publications.

Outlook

  o   Attained results will be presented at the next Wind Europe Conference: https://windeurope.org/confex2017/conference/sessions/?id=11
  o   On going investigation, on the application of isotonic regression to model fatigue loads of wind turbines, will be submitted to the journal Advanced Soft Computing