

IPID4all Doctorate Research Exchange with Royal Institute of Technology (KTH) Stockholm

Feedback report

*Dipl.-Math. Marita Blank
System Analysis and Distributed Optimisation
R&D Division Energy
OFFIS – Institute of Information Technology*

*Kungliga Tekniska Högskolan (KTH)
Power System Management with related Information
Exchange(PSMIX)
Department of Industrial Information and Control
Systems (ICS)*

*Escherweg 2
26123 Oldenburg
Germany*

*Osquldas Väg 10 , floor 7
SE-100 44
Stockholm , Sweden*

*Home supervisor: Prof. Dr. Sebastian Lehnhoff
Exchange Period: May 1st 2015 – July 31st 2015*

Host supervisor: Prof. Dr. Lars Nordström

*Exchange topic: Energy Informatics – Reliability Assessment of Coalitions for the Provision of Ancillary Services
January 2016*

Introduction

With a higher share of renewable power units (RPU) in the electrical power system, the importance increases for RPU to take part in ancillary-service provision since conventional power plants are being substituted. To this end, RPU can form coalitions. Because power being provided for ancillary services is crucial for system stability, coalitions should be assessed with regard to how reliable they can deliver a certain amount of power for a given time horizon.

The objective of the exchange researcher's PhD-project has been to develop a method for reliability assessment of ancillary-service coalitions. During the research exchange, this method has been discussed, extended and implemented. Furthermore, the concepts to evaluate the method have been discussed and implemented.

Research Undertaken

In order for renewable power units (RPU) to be able to provide ancillary services, units are represented by agents that have information about e.g. unit type, installed power, forecasts of power output or consumption. According to forecasts, flexibilities available can be computed for a certain time horizon. With that knowledge, different agents can negotiate with each other to form coalitions that – as virtual power plant – can bid on energy markets such as markets for frequency control reserves.

However, power feed-in by RPU is highly volatile. Furthermore, the power that can be procured can only be planned based on forecasts. Because power being provided for ancillary services must be available within certain temporal restrictions it must be made sure that the flexibilities can be activated when needed. Hence, coalitions should be assessed with regard to how reliably they can deliver a certain amount of power for a given time horizon.

In the course of the exchange researcher's PhD-project, the RelACs-method has been developed – a method for reliability assessment of ancillary-service coalitions. It incorporates the availability of the coalition's member units, reliability of operational equipment the units are connected to, power forecasts, forecast errors, and dependencies between the units' behaviour. These reliability facets can be considered separately or in an integrated way. The method can be utilized during formation of a coalition in order to guarantee a minimum reliability level.

The aim of the research exchange was to be in close contact with her co-supervisor and his research group in order to obtain feedback on her PhD-project and discuss extensions and collaborations.

IPID4all Doctorate Research Exchange with Royal Institute of Technology (KTH) Stockholm Feedback report

First, the exchange researcher presented her method and the corresponding use case together with her plan for evaluation. The design of the method and the concept for evaluation has been presented and discussed with the host research group. Based on these discussions, the method has been adapted according to identified gaps and the evaluation setup has been extended.

The evaluation environment for automatic evaluation and usage of methods of design of experiments has been implemented. The evaluation results have been conducted, visualized, compared and discussed with the co-supervisor and host research group.

Furthermore, the exchange researcher learned about methods and algorithms developed at the host institute as well as the organisational structure. She participated in presentations of research results and had discussions about the host researchers' projects and research.

Personal Experience

At the host research group the exchange researcher was provided with an office, desk, and screen to which she could connect her own laptop. The department provided a welcoming and open environment with friendly and helpful colleagues. The exchange researcher attended the meetings of the PSMIX research group as well as department meetings. This way she could not only learn about the research topics but the organisational structure. Beyond that, the colleagues were open for questions and discussions which were very fruitful for the PhD-project.

During July many people in Sweden go on holiday which might restrict collaboration possibilities. This should be taken into account when planning a stay in Sweden.

In contrast to the tensed housing situation in Stockholm, the exchange researcher was very lucky to find accommodation in an uncomplicated way via the KTH relocation service. The comfortable and well-furnished room was situated in walking distance to KTH. The KTH relocation service organises social events as well, which was a good opportunity to get to know the university and environment in more detail.

Conclusions

The research exchange was a good opportunity to have discussions with the exchange researcher's co-supervisor and his research group. Thus, the quality of the research could be improved and enriched by the input. In conclusion, it is advantageous to use the opportunity of research exchange to get insight in different processes and research environment as well as learn from different processes.

Outlook

The evaluation set up developed during the stay as well as the results have been incorporated in the exchange researcher's PhD-thesis. Furthermore, part of the results have been summarised in a paper that has been submitted to a conference. The PhD-thesis could be finalised shortly after the research exchange as well as successfully defended. Possible research topics for future collaboration or exchanges between the home and host research groups have been observed.

**IPID4all Doctorate Research Exchange with
Royal Institute of Technology (KTH) Stockholm
Feedback report**



Figure 1 Building of KTH guestrooms



Figure 2 Building at which ICS was located