Problem definition practical part of the MLA examination

for

MLA Group 5

TECHNISCHE UNIVERSITÄT DARMSTADT

Topic: **Performance comparison – regional differences in the wind farm**

Duration: **02.12.2019 – 02.03.2020**

Institut für Flugsysteme und Regelungstechnik

Institute of Flight Systems and Automatic Control

Prof. Dr.-Ing. Uwe Klingauf

Otto-Berndt-Str. 2
64287 Darmstadt

mla@fsr.tu-darmstadt.de

WS 2019/2020

Background

Although the basically available land potential for the installation of wind farms in Germany amounts almost 14% of the national area, many restrictions have to be made. Distance to housing estates defined by law, missing acceptance of wind farms by citizens and site owners and area development objectives of local authorities leads to a drastically reduced available space for wind farms. Therefore, and naturally for an increased economic competitiveness, the potential exploitation of wind farms is a top objective. Case studies of existing wind farms have shown substantial losses of performance due to various reasons (e.g. wake effects, regional wind speed variations etc.). Characterizing the regional differences helps identifying performance potentials as well as ensuring the stability of the energy network. Moreover, the generated knowledge can then be used to develop more efficient wind farms.

Problem Definition

Conduct a performance comparison where you identify regional differences in each wind farm individually (consider the wind farms *separately* from each other). Investigate on bundling wind turbines within the wind farm in different performance clusters. Choose a reasonable methodology to develop a schematic regional map and investigate on the reasoning of efficiency differences between wind turbines within the wind farm. Examine on seasonal differences effecting the performance history.

- **Main objective**: Identify regional differences in each wind farm within a performance comparison (consider the wind farms *separately* from each other)
- Identify meaningful physical parameters
- Analyze the existing database
- Bundle the wind turbines in different performance clusters
- Develop a schematic regional map
- Investigate on efficiency differences between the wind turbines
- Examine on seasonal differences

Further Literature

Romans Kazacoks, Bill Leithead, Lindsey Joanne Amos – *Effect of wind flow directions on the loads at wind farms*

He-Yau Kang, Meng-Chan Hung, W. L. Pearn, Amy H. I. Lee, Mei-Sung Kang – *An Integrated Multi-Criteria Decision Making Model for Evaluating Wind Farm Performance*