



Université Lille Nord de France
Pôle de Recherche
et d'Enseignement Supérieur

Ecole doctorale régionale Sciences Pour l'Ingénieur Lille Nord-de-France - 072



Titre : AC connection of wind farms on transmission system, from grid following to grid feeding

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Descriptif :

The general topic of the PhD project is the connection of large wind farms to the transmission system. With the prospect of very large penetration in the future, it may happen that no synchronous generator will be connected to the power system in a very large geographical area. Yet, these synchronous generators are currently generating the voltage on the grid. It is therefore expected that, in the future, large wind farms will no longer only be injecting active power to the grid, but instead will have to generate the voltage as the synchronous machines currently do. In other words, they will need to switch from a “grid following” connection to a so-called “grid forming” connection. This will be a real breakthrough for the wind energy production.

This fundamental modification for this kind of production is likely to happen first with large wind farms connected to the transmission grid. Many consequences may be induced by this modification to the grid synchronization. The choice made for this project is to focus on the dynamic analysis of a grid-forming wind farm and on some of the consequences on the electrical power system to which it is connected.

Two solutions exist for the connection of these wind farms on the AC grid: either AC or DC connection. In case of a DC connection, all the wind power is merged in a single AC/DC converter, transmitted to the AC transmission system by an HVDC link and converted to AC power with another converter. The control of this converter may be modified to provide a voltage source capability. In case of an AC connection, hundreds of converters are directly connected to a single point of common coupling in the AC system, and the problem becomes much more complex. One can imagine it possible to control each elementary converter as a voltage source. In this case, two main research questions arise:

Is the system, composed of all these elementary voltage sources, connected with hundreds of kilometers of cable, globally stable?

Is it possible to reduce this global system to a voltage source at the point of common coupling with the grid?



These are the two main questions that will be addressed in this PhD project.

Position Requirements

As an ideal PhD candidate:

- You have a MSc with a relevant background in electric power systems or power electronic converters with application in power systems, preferably from a reputable institute from a country within the European Economic Area.
- You should have obtained excellent study results.
- You should have the ambition to become a junior expert in power electronics modelling and offshore wind farm control and be highly motivated for a PhD project.
- You should have a keen interest to work in a team with experts studying different aspects of power electronics and power systems.
- You have experience with one or more of the following: power system dynamics, control design, power electronic converters, electrical networks
- You have excellent written and oral communication skills in English.

Location and supervision:

- L2EP is a Laboratory of Electrical Engineering and Power electronic, located at Lille. <http://l2ep.univ-lille1.fr/>
- KU Leuven
 - The Electrical Energy & Computer Architectures Electa division covers the broad spectrum of electrical energy systems and robust control of industrial systems. The development of the future smart grid is the key activity.
 - As the largest research group on electrical energy systems in the Benelux, Electa wants to be recognized as a center-of-excellence on these topics, where fundamental research is combined with immediately and prospectively applicable solutions for the industry.
 - Alongside this development of know-how, it is important is to share gained knowledge with the academic community, students, industry and the society as a whole. Electa is also co-founder of the knowledge center EnergyVille, located in Genk (Belgium).
- The position will be for one part in Lille, the other part in Leuven

The research project is managed by professors Xavier Guillaud, Frederic Colas and Jef Beerten

Contact

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