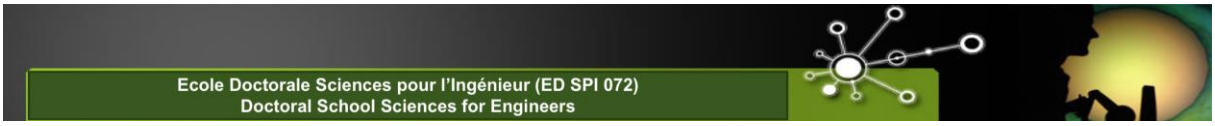

Title : Optimal placement of grid-forming and grid-following inverters to increase the stability of a transmission grid including a high proportion of power electronic converters

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Context

Nowadays, all the intermittent renewable energy sources are connected thanks to power electronic converters. Due to the increasing need of transmitting large amount of power from one place to another, more and more HVDC links are integrated in many places of Europe. Hence, a very large amount of power electronic converters can be concentrated in some areas. This results in a major modification of the power system dynamic behavior. Till now all these converters are indeed connected as current injectors based on grid following control principle and they need to be synchronized on a voltage waveform. This can induce some problems in term of stability for these areas where no equipment is explicitly generating a voltage waveform.
When switching from grid following to grid forming control, the converter is connected to the grid as a voltage source. Some studies have already shown that it can be quite helpful in term of stability to disseminate some grid forming converters in the grid to increase the stability. However, till now no explicit criteria has been defined.

Objective

The phd objectives can be divided into 3 steps:

1. In a first step, the question of the strength of the network will be addressed. Indeed, the actual solution to define the criteria is highly linked with the synchronous machine characteristics. In case a large amount of power electronic converter connected on the same grid, a new definition of the grid strength has to found.
2. Clarifying the question of the strength of grid at a given node of the network will give a good indicator to choose a grid forming or grid following control for the converter. A stability analysis on a small benchmark has to be achieved to check if this criterion is sufficient or other criterions are necessary. Then, this criterion will be tested on larger grid to prove its effectiveness on more realistic networks.
3. In a third step, an optimal criterion will be proposed to optimize the placement of the grid forming and grid following converters on a wider area.

Position Requirements

The PhD candidate will be requested to 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.

The candidate will send his CV and letter of motivation to phd.position@epmlab.eu