Master Thesis / Diplomarbeit:
Hosting Capacity and Sensitivity Analysis for Distribution Grids

The context
In distribution grids, Hosting Capacity (HC) can be defined as the maximum amount of Distributed Generation (DG) units that can be integrated into the power system above which the system performance becomes unacceptable. Different techniques for computing HC are available in the literature, which differ in input data, computational time, uncertainties, grid operational limits, assessment techniques, and performance metrics [1].

The challenge to tackle
The accurate determination of the HC level for a given distribution grid is challenged by the inherent presence of uncertain factors, such as unknown DG location, variety of unit ratings and their unpredictability, intermittent nature of DG output power due to climate changes, alteration of load profiles, and lack of confirmed system parameters when performing the power system calculations. Hence, the accuracy of these HC techniques should be properly communicated along with a global sensitivity analysis (GSA) of their underlying assumptions [2].

Research directions
The goals of this thesis are:
- To test the performance of a set of GSA methods specifically tailored for reducing the computational time of HC algorithms and suggest the fittest to be used as “screening” method. By so doing, stochastic HC studies could consider more uncertainty sources.
than usual (not only continuous but also discrete) and with higher/deeper variabilities, still keeping the computational burden under control.

- To reproduce a selected set of HC methods available in the literature and perform GSA on them to extract their “sensitivity footprint”. By so doing, it can be quantitatively investigated how the HC algorithm under study is sensitive to its uncertainty sources, hence providing a practical tool for Distribution System Operators using it and assist them for planning/operational purposes.

- To produce a reusable software to perform HC studies with enough flexibility to encompass different test grids, user-specific sources of uncertainty, DSO technical constraints, user-specific HC criteria (e.g., over/under-voltage, voltage unbalance, thermal loading, transformer overload, etc.), with an interface to perform SA.

Your profile
- RWTH student of Electrical Engineering (but students coming from other RWTH faculties or other universities are welcome to apply)
- Basic (but effective!) skills of MatLab and/or Python
- Previous knowledge of power system analysis as well as general knowledge of statistics is a plus

Notes
The supervision will be done in English.

References


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