QUICK SIMULATION OF THE LOAD ON A DISTRIBUTION GRID

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HINTERGRUND

Delocalized electricity generators, usually consisting of renewable energy sources, are becoming more and more common. In order to reasonably estimate the load of the grid, the electric network is simulated with an appropriate model including the all energy sources and users. Such a simulation can become particularly difficult, given the increasing number of the delocalized renewable energy sources, in particular with relation to their temporal fluctuation. Normally the many different possible scenarios are estimated through a Monte Carlo - Simulation (MCS). Given the complexity of the problem and the high number of variables a MCS can be unfeasible in an acceptable time frame.

LÖSUNG

For the design of the grid it is not necessary to consider the full cumulative density function, but it is usually enough to consider the 5%, 50% and 95%-quantiles. Based on the Common Rank Approximation (CRA) the problem is solved as follows:

- The possible scenarios are simulated through a simplified model;
- The 5%, 50% and 95%-quantiles are identified;
- Exact results are calculated running the correct model only for the relevant quantiles.

According to this method, the time needed for a simulation is drastically reduced. Despite the approximation, the obtained results are highly accurate.
Comparison between CRA and MCS: (upper graph) cumulative density function (CDF) of the nodal voltage varying the active power of the delocalized energy sources; (lower graph) comparison of the time needed to run a simulation. The time needed for a complete MCS was ca. 225 s, while CRA calculation can be run in less than 1 s. Pictures adapted from (1).

**VOREILE**

The invention can be implemented in a software dedicated to the design of distribution grids. The mathematical model is extremely flexible and can be applied to the design of small and big distribution grids as well.

**PUBLIKATIONEN & VERWEISE**

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