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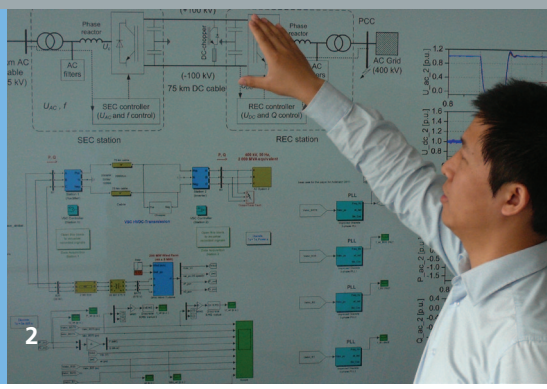

1 *Dardesheim Wind Park.*
2 *Electrical grid simulation and modeling*
Images: Dr. Thoralf Winkler, Fraunhofer IFF

ELECTRICAL GRID SIMULATION AND MODELING

Fraunhofer Institute for Factory Operation and Automation IFF

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… with know-how for the entire grid

Electrical grids are the backbone of economic and social development. The rising number of distributed suppliers of renewable energy is prompting a restructuring of the electrical grid since conventional, unidirectional energy flows are turning into bidirectional energy flows. The electrical grid is thus being operated at stability limits for which it was not designed originally. On the one hand, this can overload equipment. On the other hand, grid instability, such as frequency and voltage instability, can arise and certainty of supply is no longer guaranteed.

Grid modeling and simulation with new static and dynamic grid models is central to guaranteeing a certain and reliable energy supply nonetheless.

Your Benefits

We model and simulate electrical grids. This makes it possible to identify undesired grid conditions during planning and operation as well as in future situations and, if necessary, to ascertain appropriate fields of action. To do so, we model load flows and short circuits and run dynamic simulations. Our services enable you to:

- optimize an electrical grid by minimizing losses in the grid and optimizing costs and maximizing the electrical grid's transmission capacity,
- provide information on grid stability when, for instance, unexpected disturbances occur in the grid,
- define actions needed to counter grid instability,
- define and model protection concepts that assure dependable operation of the electrical grid and
- develop and test new functions that will be essential in future smart grids.

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Profit from Our Services

We provide the following related services.

Symmetrical and Asymmetrical Load Flow Calculation

Load flow calculation is an important method for the planning and static analysis of electrical grids. The thusly determined load flow and initial conditions are also required for other calculations such as grid analyses. We use professional grid planning software to calculate three-phase load flows, not only symmetrical and asymmetrical. This enables us to realistically analyze steady-state grid conditions in different scenarios. We provide load flow calculations for grids on every voltage level.

Dynamic Analysis and Stability Testing Using Time-Domain Simulation

Taking the load flow calculation as the starting point, we also perform dynamic grid analyses and stability calculations for our clients. We principally simulate electrical grids in the time domain. Dynamic models of grid elements, such as generators with voltage regulators and speed controllers or loads sensitive to voltage and frequency, enable us to analyze and evaluate grid dynamics and stability, e.g. voltage stability, by simulating the grid in a variety of scenarios (grid disturbances). We additionally derive potential counter measures for such stability problems.

We can simulate the following disturbances:

- short circuits of any type,
- line disconnections,
- generator disconnections,
- load shedding and
- other disturbances such as grid component overload.

Development and Evaluation of Simulation Models

In addition to static and dynamic analyses of grids, we also develop simulation models and simulate new grid components for evaluation. Grid components are modeled using the flexible, block-oriented programming in our simulation system. The advantage is the ability to connect a developed model seamlessly with any existing grid model and test it directly in various scenarios by simulation, e.g. new protective equipment for smart grid stability. We additionally validate and optimize models.

Model Optimization

We optimize the time and frequency domain of the models developed. In the process, we might optimize the parameters for dynamic grid elements or the parameters for controllers of power machinery.

Our Expertise Is Your Edge

We have the latest commercially available simulation software and apply state-of-the-art simulation systems and methods. We incorporate the latest research findings in our services. We additionally have experience calculating the load flow of grids with several thousand and nodes.

Please contact us if you are interested in our services for grid simulation. Our experts would be happy to provide you assistance.