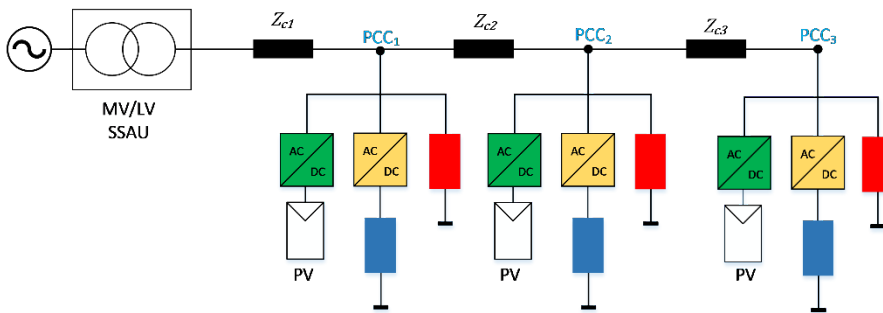


RWTH Technology

Mobile, Online and Non-Invasive Wideband-frequency Grid Impedance Measurement and Stability Monitoring Device for Low and Medium Voltage Grids



Challenge

With the increase in renewable penetration, a higher number of distributed energy resources is integrated into modern electric grids through power electronics. More and more power electronics converters operating in parallel, high control bandwidths, non-linearities introduced by phase-locked loops and parallel resonances increase the susceptibility towards harmonic instability. Therefore, devices for the measurement of the grid impedance over a wide frequency band at multiple locations in modern grids as well as their stability monitoring are essential.

Solution

Different from other solutions, our solution enables the grid impedance measurement over a wide frequency band while the grid is in operation. The measurement device can be connected in a non-invasive plug-and-play manner to measure the grid impedance at arbitrary locations of a grid. Due to the used measurement approach, the measurement's duration and impact on the grid's operation are minimized. The device and its operation are designed such that any impact of the measurement device itself on the result of the grid impedance measurement is avoided.

The proposed measurement technique can be realized as a mobile or stationary standalone device or can be integrated into existing power-electronic converters. The measured grid impedance can be processed locally or transmitted by using communication links to the grid operator's control center. By using multiple devices spread across a grid, the grid's global stability can be monitored. The device's concept can be extended from low-voltage distribution grids to medium-voltage or even high-voltage grids in a cost-effective way.

Furthermore, the obtained grid impedance measurements can be used in a novel grid emulator concept (see Technology Offer No. 2236), which enables the realistic testing and validation of power system components during research and development.

Advantages

- Mobile or stationary, low weight, low cost grid impedance measurement device
- Non-invasive, plug-and-play operation at arbitrary locations in electrical grids

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#2240

Fields of application

Measurement and stability analysis of electrical grids

Keywords

Electrical grid
Impedance measurement
Stability analysis

Patent(s)

DE 102019214533.7,
pending

Your Contact person

Dr. Roberta Caterino
Innovation Manager

Campus-Boulevard 79
52074 Aachen
GERMANY

Phone: +49 241 80-96611
Fax: +49 241 80-692614

[roberta.caterino@
rwth-innovation.de](mailto:roberta.caterino@rwth-innovation.de)

www.rwth-innovation.de

- Short measurement duration and minimal impact on the grid's operation
- Impact of measurement device on grid impedance measurement avoided
- Local processing or transmission of measured grid impedance
- Enables online stability analysis of modern power electronics driven grids
- Enables measurement-based emulation of electrical grids for realistic compliance testing and product verification of power system components

Status

- Patent application at the German Patent and Trade Mark Office. The patent application pending is not yet published in the Patent Gazette. Only after the first publication of the patent application, the applicant can derive rights therefrom and can especially claim compensation from third parties.
- The concept has been proven in simulations and a prototype has been developed and tested successfully.

RWTH Aachen University is looking for partners for patent exploitation and for research partners for joint development or contract research.