Optimal Current Injection/Extraction for Electricity Distribution Optimisation

An algorithm that is applied to an inverter so that power can either be injected into or withdrawn from the network optimally.

Published: 23rd October 2017

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Technology Overview

Researchers at UCT have developed an algorithm that is applied to an inverter so that power can either be injected into the network optimally, or withdrawn. This will become increasingly important as 'green' technologies such as wind farms and solar panels are connected to the grid. It can be applied to a single phase or multi-wire power network so that the power reaches its destination where it is consumed with minimal losses. This increases the efficiency of utility networks. Practically the algorithm is implemented through software installed on inverters and the efficiencies, increased capacity and importantly network stabilisation that result, will be of interest to utility providers who control power networks.

The most efficient way of transmitting power in a two wire single generator system occurs when the current is in phase with the generator voltage. In the case of multiple wires and generators, the way of transmitting currents with minimum losses becomes more complex to resolve, but is achieved by determining an equivalent Thévenin circuit that is representative of the whole network. A complicated mesh network may be represented as a simple Thévenin network for each phase.

The algorithm for injecting power into or extracting power from a network involves:

- Determining dynamically changing Thévenin parameters in the form of a Thévenin voltage and a Thévenin resistance of an equivalent Thévenin circuit with respect to each wire of a point of common coupling;
- Calculating a total Thévenin power for all the wires based on a specific amount of power at the point of common coupling and the determined Thévenin parameters; and,
- Calculating a dynamically changing optimal current to be injected into or extracted from the point of common coupling so as to inject or extract a specific amount of power based on the total Thévenin power and the dynamically changing Thévenin parameters.

Benefits

- Decreased losses of energy on the distribution grid thereby leading to power savings
- Improved quality in power supply to end users
- Real time information of electrical network characteristics
- Enable more autonomous intelligent distribution management systems

Applications

- Utility and network operators who control and/or manage electricity power networks
- Industries who consume large amounts of electrical energy and/or who have large reticulation systems such as a petrochemical plant, mine, heavy manufacturing entity, etc.
- Electrical network, inverter or power quality instrument and equipment manufacturers

State of Development

TRL6 – System Validation in Relevant Environment

Patents

- India 201637019587

IP Status

- Patent application submitted

Seeking

- Licensing
- Development partner
- Seeking investment