Synchronverters: Inverters that mimic synchronous generators

The Synchronverter Technology

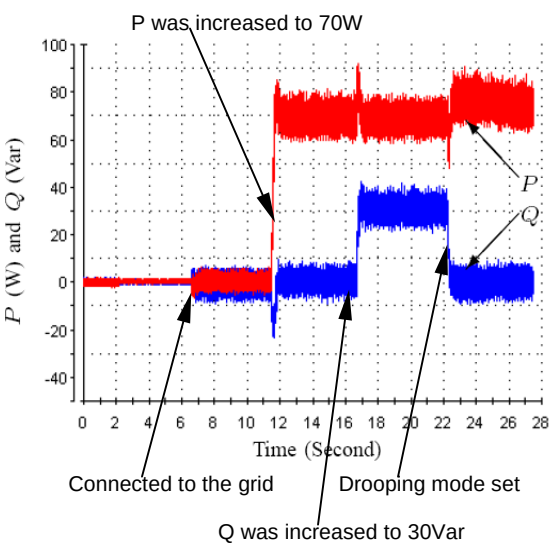
The synchronverter technology is devoted to operating inverters based on the mathematical model of synchronous generators. These inverters behave in the same way as conventional synchronous generators and thus are grid-friendly. The deployment of the technology would minimise the impact of the fast-growing number of grid-connected inverters on the grid, which is a potential threat to the overall stability of power systems.

These inverters can work in grid-connected mode and island mode. They can work alone or in parallel without an external communication channel.

When it is connected to the grid, the real power and reactive power sent to the grid can be regulated in two ways: one is to respond to the instructions of the grid operator and the other is to change the real/reactive power automatically, in responding to the variation of grid frequency and voltage, according to the pre-set frequency/voltage drooping coefficients.

Application Areas

- Distributed generation and renewable energy, such as combined heat and power (CHP), wind power and solar power. The synchronverter technology allows these sources to take part in the regulation of power system frequency, voltage and overall stability.
- Uninterrupted power supplies (UPS), in particular, the parallel operation of multiple UPSs
- Isolated/distributed power supplies, e.g. to replace rotary frequency converters
- Induction heating
- Static synchronous compensator (STATCOM) to improve power factor
- HVDC transmission (at the receiving end)



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Competitive Advantage

- Grid-friendly - Can take part in the regulation of power systems frequency and voltage
- Easily operated in parallel - No communication
- Easily manufactured - No change to the process of manufacturing inverters
- Cost-effective – Just a change to the control algorithms
- Versatile - Can be used to any power source that needs an inverter to interface with the grid or load

Market Potential

The corresponding market sector of the technology is the inverter market. It has great market potential as shown below:

- Frost & Sullivan: the India UPS market was worth US$544.4 million in 2007 and estimates this to reach US$1,316 million in 2014.
- IMS Research: The global UPS market would break the $7 billion mark in 2007.
- IMS Research: It is anticipated that the revenues from solar inverters are forecast to exceed $2 billion by 2010. The three-phase central inverter market is forecast to perform well over the next five years, driven by large-scale PV plants that are planned globally, whilst demand from residential and small-scale commercial systems will ensure that the single-phase market continues to expand.
- Frost and Sullivan: the inverter markets are destined to grow. Solar, wind and fuel-cell based power plants are consumers of inverter products. The solar and the wind based energy market is expected to grow at 25%, inducing a similar growth in the inverter market that serve these applications. According to Frost and Sullivan, the European inverter market for renewable energy systems earned revenues of Euro 654.4 million in 2007 and is predicted to reach Euro 3105 million in 2014. Across Europe, renewable energy-based inverters registered growth of 36.7% in 2007 as compared with 2006.

Intellectual Property

UK Patent (GB0820699.7) filed in November 2008. Inventors: Dr Qing-Chang Zhong (University of Liverpool) and Prof. George Weiss (Tel Aviv University).

Route forward

The technology is a platform based core technology. The exploitation plan is based on securing targeted licences across market sectors or sale of the technology.

Available information

✓ Demonstration
✓ Conference paper

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