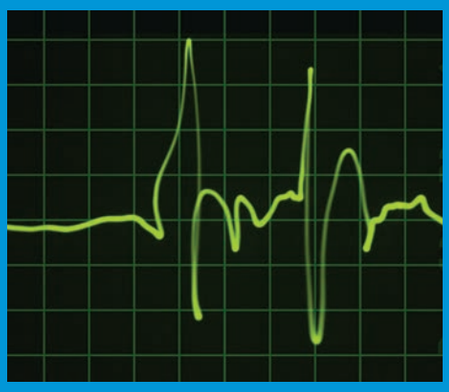
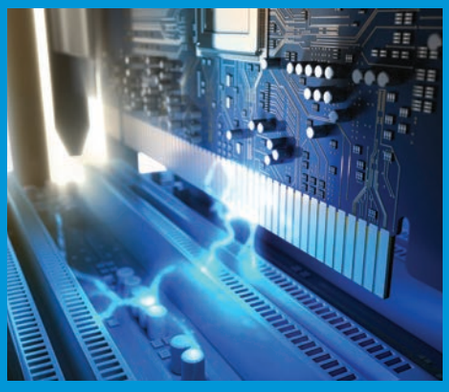
UPQC

A device for power quality enhancement

where business meets innovation

New Technology from DIT





A device for power quality enhancement

UPQC allows optimal control of a power electronics-based conditioner. Comprising both shunt and series elements (inverters), UPQC compensates for sags and swells, unbalance and distortion (harmonics) in the supply current and supply voltage respectively. UPQC delivers cost savings, increased reliability and enhanced electrical power network functionality. It also employs modular control software and novel techniques for load side short circuit protection of series inverters.

Current solutions involve regulation of the DC bus voltage but this can significantly deviate from its reference during transient events caused by load (dis)connection and supply side voltage sag and swell. DC link voltage is particularly affected when load change coincides with series voltage sag giving rise to degraded load end voltage quality.
UPQC is a complete system with an integrated digital controller, ensuring desired power quality for both the utility and the load side. The system automatically adjusts the injected current according to load conditions ensuring supply currents and load voltages are balanced sinusoids and always in phase. It can compensate for a sag or swell of up to 50% in the supply voltage and has an efficiency of greater than 90%.

UPQC has been designed to a European specification (3 phase - 3 wire) but can easily be adapted to operate to US and Asian supply voltages. Energy storage modules may also be added to give the system uninterruptible power supply (UPS) functionality.

Applications

Power electronics-based conditioning is important across multiple industrial sectors. The UPQC may be used by a number of industries including:

- Utilities (transmission and distribution companies);
- Process industries (semiconductor plants, paper mills, plastic manufacturers);
- Automotive manufacturers;
- Chemical plants, Electronics (consumer electronic and computer manufacturers); and
- Mining industry, Steel plants.

Opportunity

The market for power electronics globally was worth nearly $11.5 billion in 2014. With a growth rate in excess of 6% it is expected to reach $16 billion by 2019.

A number of factors are influencing the power-conditioning segment across the grid. These include advanced automations, i.e. real-time control and monitoring; the addition of fast acting power conditioning apparatus; customer based reliability and power quality enhancement; and micro-grids for Outage management.

UPQC has the potential to fit into the area of power conditioning and quality enhancement.

Advantages

The UPQC offers a number of advantages over existing solutions, including:

- Increased Grid Reliability – reduced risk of mal-operation or failure of loads from power quality problems originating from the network.
- Harmonic Protection – greatly reduces the level of harmonics being injected back into the network from disrupting electrical loads.
- Voltage Sag Mitigation – caters for up to 50% voltage sag from the utility supply.
- Efficient DC Bus Control – a novel adaptive controller ensures that during severe voltage/current disturbances, the change in the dc link voltage is steady. It can follow the reference at all times to ensure injected voltage and current harmonics are kept to the minimum.
- Renewable Energy Integration – allows wind generation and other renewable energy supplies to be accommodated into electricity supply networks, by increasing their voltage ride through capability in the event of short duration grid voltage disturbances.

> "The technology has been built, tested and is capable of demonstration via a 12kVA prototype"

- Full Integrated Digital Controller – provides flexibility to adjust control algorithms or tuning parameters if required.
- Quality of service – enhances both the availability and reliability of existing electricity supply networks.
- Modular design – simplifies both manufacturing and maintenance.

Stage of Development

The UPQC was developed in the Electrical Power Research Centre in Dublin Institute of Technology (DIT) Kevin St., supported by funding from Enterprise Ireland.

The technology has been built, tested and is capable of demonstration. A 12kVA prototype has been developed but it will require further commercial development to automate and scale up.

The software modules, power conditioning models and the overall system architecture are protected as confidential know-how.

Research on renewable energy applications is on-going.

DIT is currently seeking expressions of interest from potential business partners and licensees interested in developing the technology, particularly in the renewable energy sector or for mechanical dampening applications.

DIT Hothouse Technology Transfer Office
Dublin Institute of Technology,
Aungier St, Dublin 2
+353 1 402 7179 hothouse@dit.ie
www.dit.ie/hothouse