Advanced Current Transformer for Power Transmission

BACKGROUND

High-voltage AC current measurement has traditionally been carried out using magnetic-core based instrument transformers. These are now considered problematic for a number of reasons, including size and use of insulating material, difficulty in installing on thick, high voltage conductors, inaccuracy due to the non-linear effect (hysteresis), flux residue and the risk of catastrophic failure due to ageing, leading to arcing and even explosion.

Recently, optical current sensors – using the Faraday rotation effect or a power electronic element - have been marketed as beneficial alternatives to outdated current transformers. However, uptake by the power industry has been limited, as a result of inherent disadvantages with existing optical sensing techniques, including:

- the weak Faraday rotation effect
- instability arising from sensitivity to environmental factors, including vibration
- perceived unreliability and short service life of power electronics and related power supplies.

Figure 1: Traditional current transformer

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A University of Manchester research group has developed a novel current sensor for use in an optical current transformer that provides the high stability needed for high voltage (HV) environments.

THE TECHNOLOGY

Unlike other optical current sensors, The University of Manchester's new advanced optical current sensor exploits modulation rather than Faraday rotation and this provides a route to optical transformers that:

- are easy to manufacture
- have lean power needs
- are low profile and low maintenance
- have improved sensitivity and reliability
- are vibration resistant
- offer long service life in adverse conditions
- are safe, with low environmental impact
- are compatible with existing equipment and are IEC 61850 compliant

The sensor does not require a power supply for the voltage-optical modulation unit and is insensitive to vibration. This gives the sensor reliability and provides an efficient and accurate option to network operators, with potential to provide a long term replacement for traditional current transformers. A programme of work is currently planned to test the sensor in live EHV systems, in an IEC-61850 compliant environment.

APPLICATIONS

The system is highly suitable for the electricity transmission and distribution networks, particularly for control of electrical supply in response to dynamic loading.

INTELLECTUAL PROPERTY

The technology is wholly owned by the University of Manchester and is protected by international patent filings published as WO2014091233A1.

Figure 2: Prototype on test

OPPORTUNITY

A prototype device, developed in conjunction with SSE and National Grid, has been tested in the National Grid HV laboratory at the University. Interest in this technology has been expressed by network operators and manufacturers and we are seeking partners from these sectors, particularly those with global market access, to collaborate in this licensing / development opportunity.

CONTACT

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