

Implementation of a New Method for an Improved Voltage Dips Evaluation by the Italian Power Quality Monitoring System in Presence of VT Saturation Effects

R. Chiumeo¹, M. de Nigris¹, L. Garbero¹, C. Gandolfi¹, L. Tenti¹ and E. Carpaneto²

¹ ERSE - Enea Ricerche Sul Sistema Elettrico
Via Rubattino 54 – 20134 Milano (Italy)

Phone:+390239925126, Fax:+390239925557, e-mail: Riccardo.Chiumeo@erse-web.it, Michele.denigris@erse-web.it,
Luciano.Garbero@erse-web.it, Chiara.Gandolfi@erse-web.it, Liliana.Tenti@erse-web.it

²Politecnico di Torino - Dipartimento di Energia Elettrica
C.so Duca degli Abruzzi 24 - 10129 Torino (Italy)

Phone:+390115647138, fax:+390115647199, e-mail: enrico.carpaneto@polito.it

Abstract

The paper deals with a recent measurement improvement introduced into the Italian power quality monitoring system, concerning voltage dips detection and their proper evaluation in the presence of voltage transformers (VT) saturation phenomena. Saturation effects, essentially on network operated with isolated neutral, can give origin to “false” voltage dips, which can affect the on-line voltage monitoring during a few specific events (i.e. single line-to-ground faults). The “false dip” problem, on the other hand, can be considered negligible in compensated neutral networks.

The Italian power quality monitoring system QuEEN has been performing Power Quality (PQ) measurements in the MV distribution network since 2006 and on about 600 instruments distributed all over the Italian territory (400 units installed in HV/MV substations, 200 units installed along the MV lines).

The assessment of PQ performances across the country, during a long-term period campaign, could be very useful for regulation activity provided that the system is periodically submitted to some indispensable technical updating from the point of view of both measurement techniques and data evaluation methods.

The QuEEN system makes use of existing VT in HV/MV substations and performs PQ measurements according to the international standard IEC EN 61000-4-30. Measurement Units (MUs) are connected to the LV side of voltage transformers, whose primary windings are connected between phase and ground.

In this kind of system configuration a single phase-to-ground fault or line energization may cause the saturation of the voltage transformers giving place to the measure of “false” voltage dips which badly affect the dip-performance evaluation of the MV distribution network, especially in

those networks operated with isolated neutral. In this case a specific software countermeasure is needed.

The “false dip” problem can be considered negligible in compensated neutral networks and do not concern MU placed along the MV lines because of the different voltage transformers network connection (primary winding line-to-line connected).

In order to cope with this potential drawback, an advanced criterion, to distinguish “false” dips from the “real” ones, has been developed in cooperation with the Polytechnic of Turin. The criterion, based on the detection of a second harmonic component in the measured voltages, has been implemented in the QuEEN system on May 2009 after a simulation activity carried out by the Polytechnic in 2008 and a testing campaign performed at ERSE labs in Piacenza. The method replaces a former digital filter active in the system, based on the asymmetry of the measured voltage waveform.

In this frame the criterion developed classifies voltage dips into three types: real ones, false ones and undefined; the last case corresponds to a not univocal evaluation of the event.

The first advantage of the new filter is that neutral isolated networks can be considered similar to the compensated ones from the point of view of voltage dip performance.

Key words

Power Quality, Monitoring System, Voltage Dips, Transformer Saturation, Distribution Networks