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The Italian MV network dip performance characterization by contour charts as defined by UIE/CIGRE'/CIRED WG-C4.110

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Abstract Reporting and analysis procedures play an important role in power quality monitoring systems especially for long term surveys. As far as voltage dips are concerned, the network voltage dip performance can be effectively described in many different ways depending on the aims of the data presentations at both site and system level.

The paper deals with network dip performance different representation methods focussing in particular on the way of presentation proposed by the working group UIE/CIGRE'/CIRED C4.110.

This method has been applied to the Italian 2009 voltage dips statistic as acquired by the Italian power quality monitoring system named QuEEN. Contour charts have been drawn for both different percentage of the monitoring sites and voltage dips types.

Key words

Power Quality, Network Voltage Dips performance, PQ Indices, Contour Charts, Percentile method.

1. Introduction

The Power Quality performance of a network is usually assessed by long term monitoring campaigns carried out on field, providing to have a proper number of monitoring sites which could be considered representative of the network itself. In this context the Italian MV network monitoring system named QuEEN (no less than 600 points of measurement, 400 of which installed in primary substations [1], [2]) has been collected power quality data since February 2006 providing a lot of power quality data to represent the network performance.

As far as voltage dips are concerned, the network voltage dip performance can be effectively described in many different ways at both site and system level, that is, in the last case, referring to all the monitored sites at once.

Starting from the presentation of simple voltage dips tables, the network voltage dips performance can be represented in a more synthetic way by a set of single system indices or in graphical forms as simple iso-numerousness curves maps or, finally, by the dip coordination charts proposed by the working group UIE/CIGRE'/CIRED C4.110 [3], [4].

The adoption of the last one kind of presentation should enable the estimation of the number of end-user equipment malfunctions due to voltage dips providing to known the voltage dips characteristic typical of a network and end-user equipment response to dips in the form of, so called, equipments immunity curves.

The coordination charts, presented hereafter, are based on the voltage dips data acquired by the Italian monitoring system QuEEN in 2009 at the 400 measurements sites placed in a same number of primary substations. The monitored sites can be considered representative of the Italian MV distribution network (about the 11% of the total amount of MV bus-bars). An example of application of dip coordination chart is presented.

This activity has been carried out by RSE - Ricerca sul Sistema Energetico, in the frame of the Research Fund for the Italian Electrical System, and regards tasks focused on power quality.

2. Voltage dip performance presentation methods

A certain number of network voltage dip performance presentation methods have already been proposed at international level at both site and system level depending on the statistical aspects to which one is going to pay attention.

A typical representation method of voltage dips statistic consists in classifying the events, monitored during a survey period, in tables on the base of their duration and residual voltage, providing for each events class its numerousness at site level or other statistical quantity as the 95% percentile.

Referring to this representation method (named in the following as tabular method), the new edition of the standard EN 50160 Ed. 2010 proposes a voltage dips classification strongly related to the immunity curves for class 2 or class 3 equipments, as they have been defined