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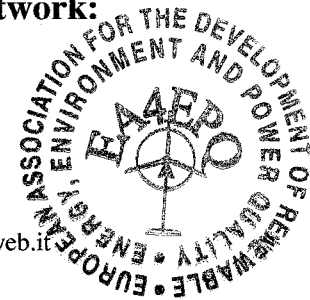
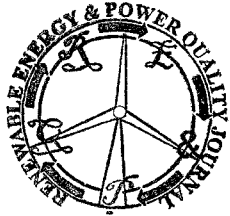
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A Three Phase Photovoltaic Power System Connected to the MV Network: Behaviour during Voltage Dips

R. Chiumeo, C. Gandolfi

RSE- Ricerca Sul Sistema Energetico,
Via Rubattino 54 – 20134 Milano (Italy)

Phone/Fax number:+390239921, e-mail: Riccardo.Chiumeo@rse-web.it, Chiara.Gandolfi@rse-web.it



Abstract The presence of Distributed Generation (DG) in the distribution network is increasing and represents one of the most important research areas. Several reasons have forced this increase like the possibility to use renewable resources reducing the fossil fuels use with environmental and energy benefits.

The paper deals with the results of a study performed by RSE, in the frame of the Research Fund for the Italian Electrical System, focused on the behaviour during voltage dips of a “DG system”, consisting in a Photovoltaic generator (PV) connected to the network with three phase Voltage Source Inverter (VSI).

Key words

Distributed Generation (DG), Photovoltaic power system (PV), Voltage Source Inverters (VSI), Fault Ride Through (FRT), Voltage Dips.

1. Introduction

Several reasons have forced the Distributed Generation (DG) presence increase in the distribution network, among them the possibility to use renewable resources reducing the fossil fuels use with environmental and energy benefits has a particular importance. Moreover this issue represents one of the most important research areas.

Among renewable resources Photovoltaic arrays are one of the DG sources that have shown a continuous growing trend in the last few years. Distributed Generation is typically connected to the AC distribution network using power electronic devices like Voltage Source Inverters (VSI).

With this increase of DG and the consequent evolution of the distribution network from a passive to an active system new issues, relevant to the Distributed Generation impact in the network, have to be considered during steady state and transient conditions.

In this contest, the paper deals with the results of a study performed by RSE, in the frame of the Research Fund for the Italian Electrical System, focused on a “DG

system”, with a Photovoltaic generator (PV) interfaced to the network with three phase VSI.

The main issue of the study is to investigate possible control methodologies for interconnecting PV arrays to the distribution power system, taking into account also the new proposals for the Fault Ride Through (FRT) during the voltage dips occurrence.

2. Three Phase MV Network Connected to a Photovoltaic Power System

The study has been focused on the Medium Voltage (MV) network and performed with digital simulations in ATPdraw (Alternative Transient Program) with the main goals of analyzing and understanding:

- the PV plant design;
- the behaviour of the system during voltage dips in the MV network;
- the possible control methodologies for the Fault Ride Through capability [1] ÷ [3].

The structure of the simulated system consists of (Fig. 1):

- a PV array;
- a DC/DC BOOST converter to extract the Maximum Power Point Tracking (MPPT) from the PV array and to increase the output voltage to a level suitable for the inverter;
- a two level three phase VSI to connect the DG to the MV network through a MV/LV transformer.

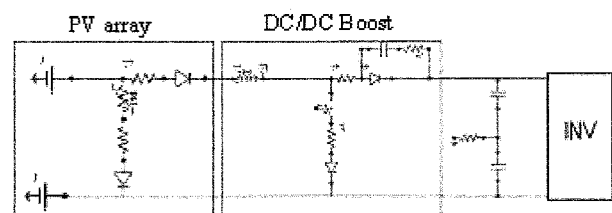


Fig. 1: Simulated system: simplified structure