Study the Harmonics Propagation in Electrical Grid Connected Photovoltaic System

Y.Djeghader[1], A.Lakehal[2], and Z.Chelli[3]

[1,3] Department of Electrical Engineering, University of Mohamed-Cherif Messaadia ,Souk Ahras, ALGERIA .
[1]E-mail : djeghaderyacine@yahoo.fr , and yacine.djeghader@univ-soukahras.dz
[1.3]LEER Laboratory University of Mohamed-Cherif Messaadia ,Souk Ahras, ALGERIA;
[2] Department of Mecanical Engineering, University of Mohamed-Cherif Messaadia ,Souk Ahras, ALGERIA .

Abstract: Renewable energy sources (Res) are being connected to an electrical system using electronic power devices. The use of these devices generates harmonic currents and degrades the quality of energy. This article presents the study of the integration of photovoltaic systems in the electrical grid (low voltage) with and without the presence of a non-linear (three-phase rectifier PD3). In this paper, we use the MPPT controller for Boost converter, and the PWM control for the three-phase inverter that ensure the connection. The simulation results obtained without the non-linear load show that the waveforms of the currents propagated in the PV system or in the electrical grid are very close to the sinusoid, and the values of the total harmonic distortion (THD) rates are in the standard used. On the other hand, the presence of the non linear charge degrades the waveforms of the currents and gives us THD values higher than the norm.

Keywords _, Electrical Grid, Boost converter, Inverter , Photovoltaic System, Powr Quality , MPTT , THD.

I. INTRODUCTION

With the technological development the demand for electric energy increases and due to the depletion of fossil fuel resources. Renewable energy sources (RES) are rapidly gaining an important place in sustainable electricity production because they are less polluting and use resources that are always readily available [1,2]. Renewable energy sources, which should be a promising alternative energy source, can pose new challenges when connected to electricity grids [2]. In recent years, solar energy has become one of the most important sources of energy in the worlds largest renewable, which requires additional transmission capacity and better ways to maintain system reliability [1,2 and 3]. The integration of renewable energies with traditional conventional electrical grids plays a predominant role in distributed generation systems and especially photovoltaic systems (PV) connected to the low voltage grid are particularly popular [3,4].
The rapid growth in the use of non-linear loads and their generalization in power grids cause the problem of deterioration of the power quality [4]. Power Quality (PQ) related issues are of most concern nowadays. The widespread use of electronic equipment, such as information technology equipment, power electronics such rectifiers used in many applications. , energy-efficient lighting, led to a complete change of electric loads nature. These loads are simultaneously the major causers and the major victims of power quality problems [5, 6,7]. Due to their non-linearity, all these loads cause disturbances in the voltage/current waveforms.
A load is said to non-linear if it fed by a sinusoidal voltage, but the current absorbed by this load no sinusoidal. This type of loads receiver generates harmonics currents [8,9]. we analyze a three-phase rectifier (PD3) as a non-linear load. It is known that without proper power, an electrical device may not function properly, fail prematurely, or fail at all. To deal with these problems and reduce the effects of harmonic currents.
In this paper, we applied two simulation scenarios (we use MATLAB simulink): the first is to simulate the integration set without nonlinear load , and the second to simulate the integration with the pollutant load (PD3). In each scenario we focus on the waveforms of the currents flowing to the PV system (PV current), and the currents propagating towards the electrical grid (Grid current). Our goal is summarized in the analysis of the quality of the waveforms of currents and harmonics while determining the values of the total harmonic distortion rates **(**THD) that exist in each scenario and see its harmonic spectrum .

II. SYSTEM DESCRIPTION

The structure of the proposed integration system is shown in Figure 1.

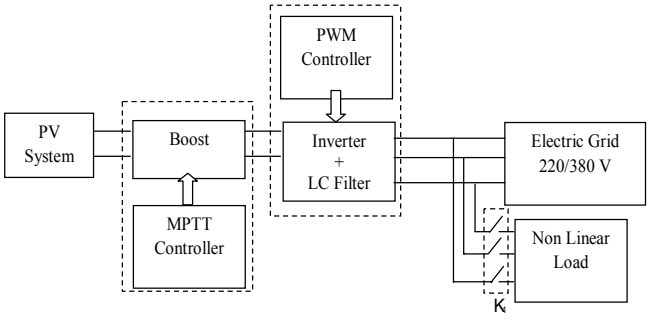

Figure 1 Integration system studied