Optimal Embedded System for Two-Axis Tracking PV Panels

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Abstract: - A PV tracker system is a solution one of those methods able to increase the PV power generation. Theoretical, a PV tracker system with two-axis, can increase the overall solar energy capture about 45%, compared to a fixed PV module tilted at an angle equal to the local latitude. An one-axis tracking system, the increase is aproximately 32%.
In this paper, we design and implement a two-axis tracking system of photovoltaic (PV) systems, who follows the maximum power point (MPP) using a programmable circuit XILINX type Complex Programmable Logic Device- CPLD and Xilinx ISE software. Thus, PV module will reach its MPP in relation date and time of the day. The test bed relies on an algorithm integrated in the XILINX who has as inputs: date, location's latitude and longitude, the standard longitude (related to the location's position in relation with Greenwich), and the number the positions of the Sun's path.
To establish the position of the panel in a time of day value is determined by the following calculations: the angle of the day, correction factor of Earth's orbit, the solar declination angle, the equation of time in minutes, eastern time using latitude angle, the number of hours the Sun shines using angle eastern time, time the Sun sets, vectors containing the coordinates of the positions of the Sun (in this case 10 positions) during the day and azimuth angle.

Key-Words: - Renewable sources, PV systems, PV Tracker, programmable circuit, Complex Programmable Logic Device.

1 Introduction

Renewable energy sources (RES) are getting more and more widespread, mainly due to the fact that they generate energy by keeping the environment clean. Theirs rapid evolution of RES during the last two decades materialised in a lot of RES power systems all over the world. A disadvantage of these power plants is the high cost of the installation. In this respect, the approaches trying to optimise the design of these ones are well wellcome. However, such an effort requires detailed knowledge, e.g. the meteorological data of the site where the system will be installed and operational results from similar systems, if available. [1] and [2]

A PV tracker system is a solution one of those methods able to increase the PV power generation. Theoretical, a PV tracker system with two-axis, can increase the overall solar energy capture about 45%, compared to a fixed PV module tilted at an angle equal to the local latitude. An one-axis tracking system, the increase is approximately 32%. [3]

In this paper, we design and implement a two-axis tracking system of photovoltaic (PV) systems, who follows the maximum power point (MPP) using a programmable circuit XILINX type Complex Programmable Logic Device - CPLD and Xilinx ISE software. Thus, PV module will reach its MPP in relation date and time of the day. The test bed relies on an algorithm integrated in the XILINX who has as inputs: date, location's latitude and longitude, the standard longitude (related to the location's position in relation with Greenwich), and the number the positions of the Sun's path.

Sun path refers to the apparent significant seasonal-and-hourly positional changes of the sun (and length of daylight) as the Earth rotates, and orbits around the sun. The relative position of the sun is a major factor in the performance of solar energy systems. Accurate location-specific knowledge of