

Modeling and Simulation an Electronic Programmable System to Connect the Photovoltaic Module with the Utility Grid¹

Mohammed Aref Ne'ma²

Ahmad Kussay Kayali³

Mohammed Riyad Sabouni⁴

Abstract

This research introduces a study and design of a programmable electronic system. The study connects the photovoltaic module with the utility grid, through the modeling and simulation of asuitable electronic system to present the solar power as an electrical power on the utility grid. This electronic system is represented by a DC-AC inverter including DC-DC boost converter working with the sliding mode control (SMC) in order to maintain the stability of the output voltage against the changes of voltage and current in the input and at the load. This research describes a new method uses the symbolic analysis in MATHMATICA. This method is used to study a passive low pass filter (LPF) with the 10th Base and 6th order degree from ABB model with 60Hz cut-off frequency.

¹ For the paper in Arabic see Pages (201-237).

² Ph. D student - Department of Electronic Engineering, Faculty of Electrical & Electronic Engineering, University of Aleppo.

³ Department of Electronic Engineering, Faculty of Electrical & Electronic Engineering, University of Aleppo.

⁴ Photovoltaic Conversion Laboratory, Scientific Studies & Research Center Aleppo Branch.

This filter is used to improve the total harmonic distortion (THD) to become less than 3% in order to connect to the utility grid. The research also uses an active method to remove the special obstacles which prevent the ability of connection to the utility grid. The method depends on a principle of measuring differences in frequency, phase, and amplitude. The synchronization state is achieved by removing the whole differences in a programmable way. The measuring results which were obtained from the inverter with boost converter system leads to a total efficiency of 87% when using a chopper boost converter in the inverter circuit, this in turn enhances the efficiency of the whole electronic system which has been studied in this research, and this case is the optimal in dealing with photovoltaic systems.