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Original Research Article

Grid Connected Photovoltaic System Using Solar Cell

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Abstract: A single phase grid connected with a photovoltaic (PV) power system that will provide high voltage gain with state model analysis for the control of the system has been presented. First the photovoltaic system is designed and simulated using MATLAB SIMULINK software. The output voltage of a PV array is comparatively low thus high voltage gain is necessary for grid-connection and synchronization. The PV system has been provided with a boost converter which will boost the low voltage of the PV array to high dc-voltage. A steady state model is obtained and is verified with the help of simulation. A full bridge inverter with bidirectional power flow is used as the second power processing stage, which stabilizes the dc voltage and the output current. Further, a maximum-power-point-tracking method is employed in the PV system to obtain a high performance. The photovoltaic (PV) energy effect can be considered an essential sustainable resource because of solar radiant energy abundance and the sustainability thus grid connected photovoltaic system is widely used, although solar energy is available abundantly and free of cost, the cost of the photovoltaic cells is very high. Hence the initial investment on solar energy will be very high. The basic element of a PV system is the solar cell which converts the solar irradiance into direct current. Grid interconnection of PV system requires an efficient converter to convert the low DC voltage into AC. The Gate Diffusion Input requires twin well CMOS or silicon on insulator (SOI) process for fabrication. Depending on the weather and the day time, the amount of electrical energy generated by the solar panels changes which is a problem for the system powered by photovoltaic systems. Grid-connected PV systems can cause problems on the grid, such as injecting more harmonics or reducing the stability. The main objective is to develop a power electronics interface for a three-phase grid connected PV with SIMULINK and Monte Carlo model. To calculate the current and voltage and to compare proposed working model with other existing models.

Keywords: Photovoltaic, grid, DC, AC cells, current and voltage etc.

I. INTRODUCTION

Grid-connected PV systems are usually installed to enhance the performance of the electric network by reducing the power losses and improving the voltage profile of the network. However, this is not always the case as these systems might impose several negative impacts on the network, especially if their penetration level is high. Such negative impacts include power and voltage fluctuation problems, harmonic distortion, malfunctioning of protective devices and overloading and under loading of feeders.

Studying the possible impacts of PV systems on the electric network is currently becoming an important issue and is receiving a lot of attention from both researchers and electric utilities. The main reason for the importance of this issue is that accurate evaluation of these impacts, as well as providing feasible solutions for the operational problems that might arise due to installing PV systems, is considered a major contribution towards facilitating the widespread use of these systems.

II. PHOTOVOLTAIC SYSTEM

A photovoltaic (PV) cell is a particular electrical gadget that can change over sun-oriented vitality into direct current by photovoltaic impact. It is coordinated piece of sun-oriented vitality framework

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and is an imperative wellspring of option wellspring of vitality. The PV cells are made of silicon consolidated or doped with diverse components to influence the conduct of electrons or openings.

Diverse materials, for example, copper indium diselenide (CIS), cadmium telluride (CdTe), and gallium arsenide (GaAs), are produced for utilization in PV cells. In a PV cell, these bits of materials are put together. The gadget is developed in such a route, to the point that the intersection can be presented to obvious light, IR, or UV.

At the point when such radiation strikes the P-N intersection, a voltage contrast is delivered between the P sort and N sort materials. Terminals joined with the semiconductor layers permit current to be drawn from the gadget. Metallic contacts are given to associate the heap to the cell. The cell is set under a glass spread joined to it by glue for mechanical assurance. The proficiency of a sunlight-based cell fluctuates between 15%-19% and builds up an open circuit voltage of the request 0.65 V and a most extreme current thickness between 35-40mA/cm2.

WORKING PRINCIPLE

Vitality changes in sun powered cells works of two vital steps. First and foremost, assimilation of light produces an electron gap pair. The electron and gap are then isolated by the structure of the gadget electrons to the negative terminal and openings to the positive terminal-subsequently creating electrical force.

A perfect sun oriented cell is spoken to by a present source associated in parallel with a correcting diode, as indicated in the identical circuit of Figure. The relating I-V trademark is portrayed by the Shockley sun powered cell mathematical statement:

$$I_L = I_D + I_{sh} + I \quad (1)$$

$$I_D = I(e^{\frac{q(V+IR_S}{KTA}} - 1) \quad (2)$$

$$I = I(e^{\frac{q(V+IR_S}{KTA}} - 1) - \frac{V+IR_S}{R_{sh}} \quad (3)$$

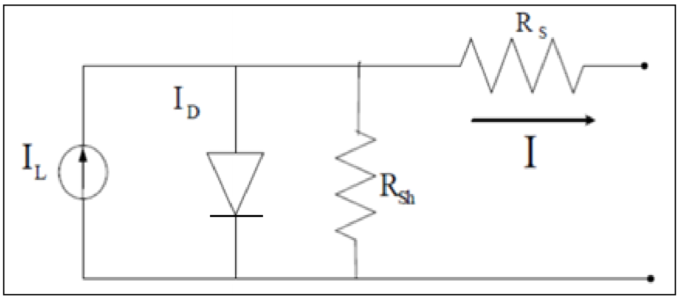


Figure 1. Equivalent circuit of a solar cell [3]

VO: voltage appearing across diode.
V: load voltage.
I: Cell Current (A)
RS: internal (series) resistance of the system.
IO: Reverse saturation current of the diode.
T: Temperature in Kelvin.
K: Boltzmann constant (1.38 x 10-23 J / K).
n = Ideality factor (≈1.92).
q: electronic charge (1.6 x 10-19C).

The output of the solar cell i.e. the P-V and I-V curve is given in the following figure.

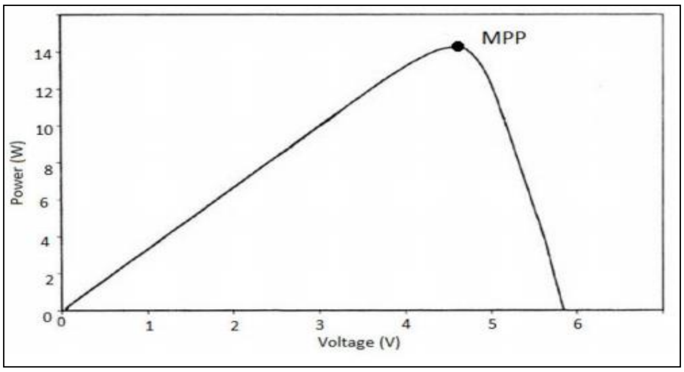


Figure 2: P-V Characteristics [3]

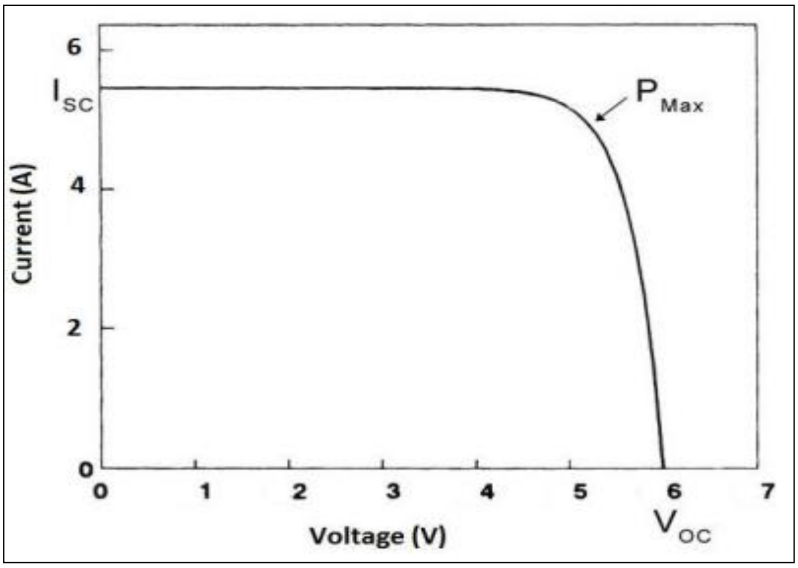


Figure 3: I-V Characteristics [3]

III. RESEARCH PROBLEM

There are different Problems that are given below:

- The Gate Diffusion Input requires twin well CMOS or silicon on insulator (SOI) process for fabrication.
- Depending on the weather and the day time, the amount of electrical energy generated by the solar panels changes which is a problem for the system powered by photovoltaic systems.
- Grid-connected PV systems can cause problems on the grid, such as injecting more harmonics or reducing the stability.
- The FC (flying capacitor) grid-connected inverter, due to large number of capacitors, capacitor voltage balancing problem.

IV. RESEARCH METHODOLOGY

The system is composed mainly as following: Photovoltaic array converts the sun irradiance and generates dc voltage and current, the DC-DC boost converter controlled by maximum power point tracking using (P&O) algorithm to track the maximum power point of the array then the three phase Inverter converts the dc voltage to AC for grid interfacing or supply to the local load. The performance of simulation of this topology was performed using the MATLAB Software. The parameters are used in simulation. In this section, comparison of different parameters such as inverter voltage, common mode voltage (CMV), leakage current and the performance of proposed topology under changes of reactive and real power are discussed.

LAYOUT OF THE PROPOSED METHOD

The main idea of the proposed method is to use the huge amount of the available data in an efficient and intelligent manner, while preserving the temporal information. This can be achieved by first dividing the long historical time series of the calculated PV power into segments. The results generated from using the representative segments can either be utilized directly to evaluate the performance of the feeder or can help identify the groups of segments that require further analysis.

Efficiency calculation According to the actual in-plane irradiation G and the module temperature T, a PV array always offers a certain DC-power PMPP. However, under steady-state conditions, the inverter can only extract

$P_{DC} = \eta_{MPPT} \cdot P_{MPP}$ and converts it to $P_{AC} = \eta \cdot P_{DC}$

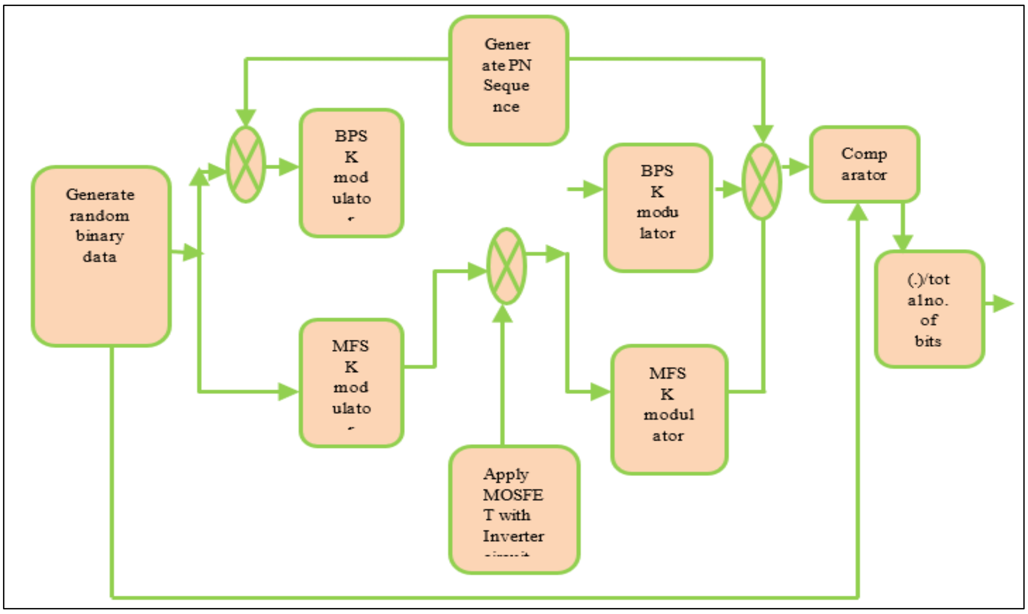
Actually the inverter efficiency is a ratio of AC power and DC power. The total efficiency of a grid- connected inverter can be defined as:

$$\eta_{tot} = \eta \cdot \eta_{MPPT} = \frac{PAC}{PMPP}$$

PROPOSED STEPS

Step 1: Start the work.
Step 2: Select voltage, current and other components to design model.
Step 3: Apply AC and DC converter in circuit.
Step 4: To develop a power electronics interface for a three-phase grid connected PV with SIMULINK.
Step 5: Apply Monte Carlo model and MOSFET to design inverter circuit.
Step 6: Calculate the current and voltage.
Step 7: Ccompare proposed working model with other existing models.

Block diagram of the Monte Carlo simulation model



V. RESULTS & DISCUSSION

This includes the final results of the research work that is to be implemented in the MATLAB. The different figures of the research works are given below:

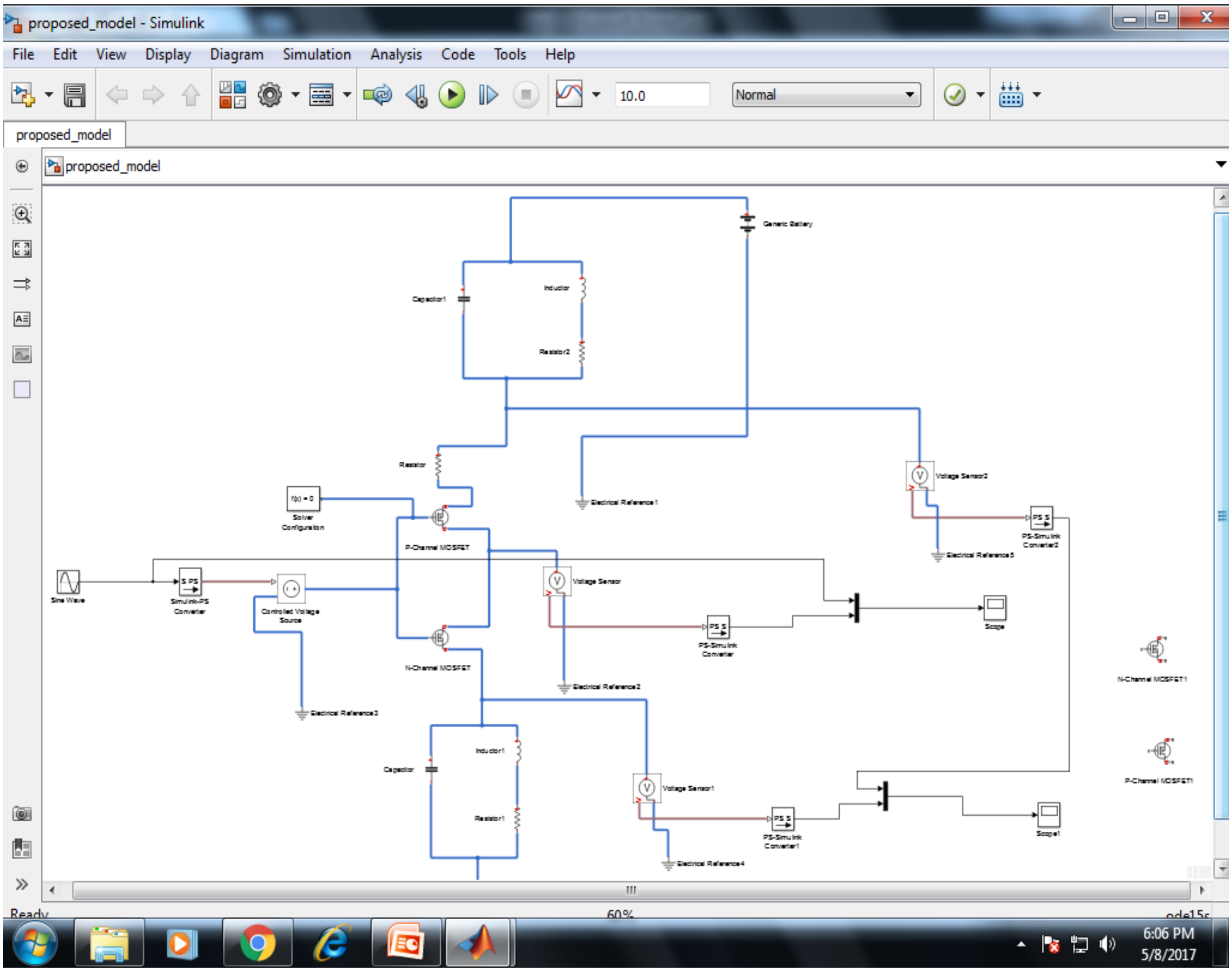


Figure 4: Simulation Diagram for Proposed System with MOSFET

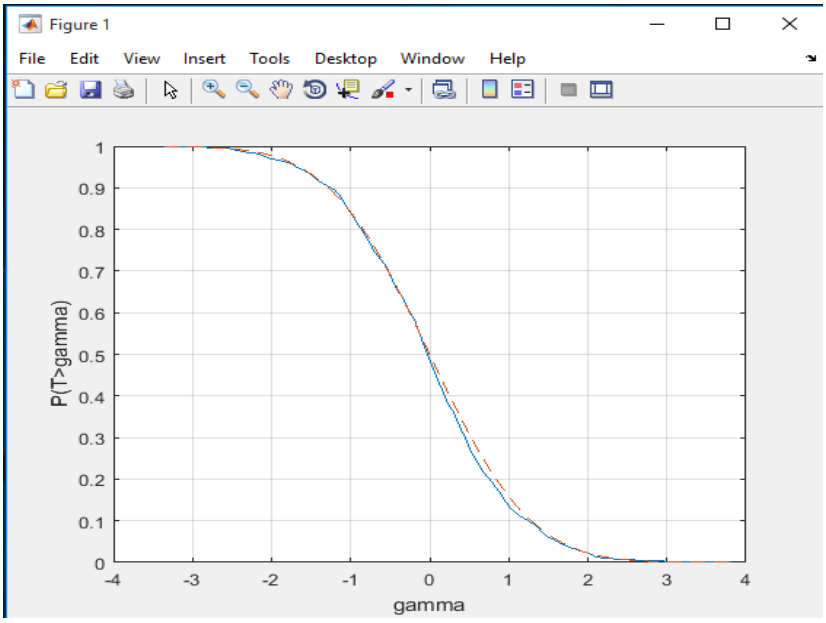


Figure 5: Graph for MOSFET

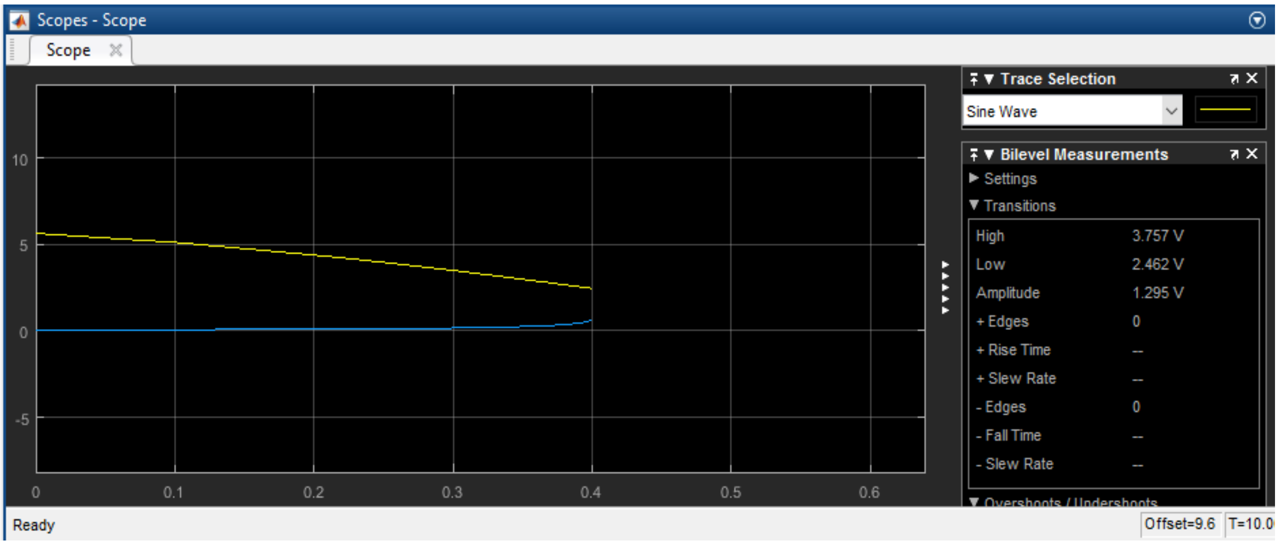


Figure 7: Existing System Graph for voltage and Current

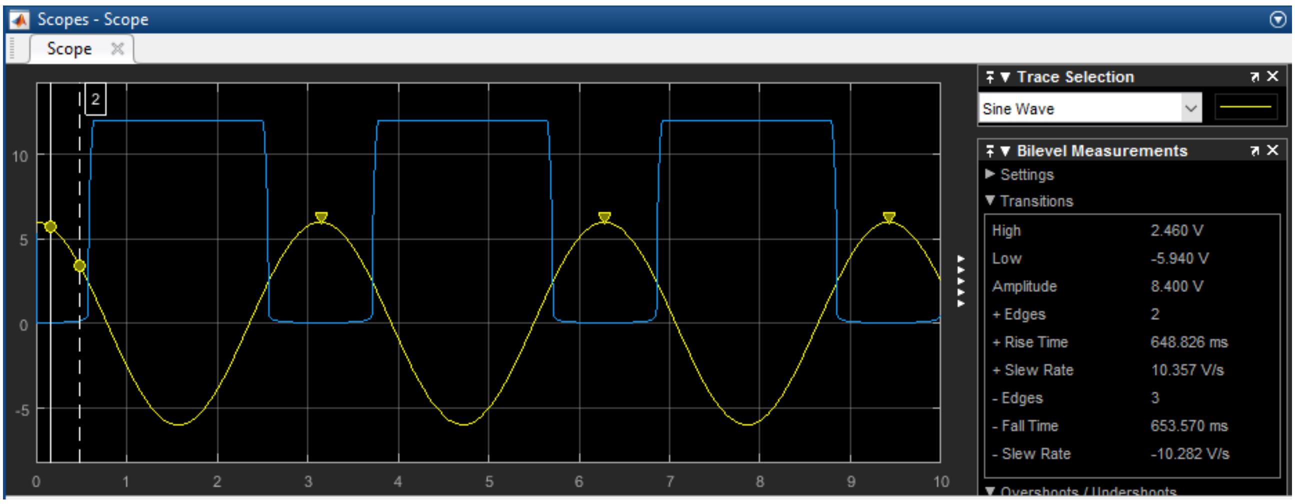


Figure 8: Existing model for voltage and Time etc.

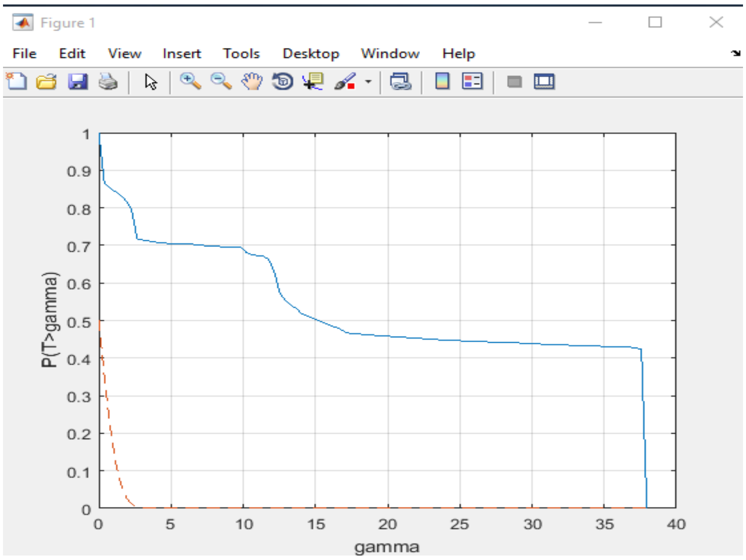


Figure 9: Existing system for Gamma and Time

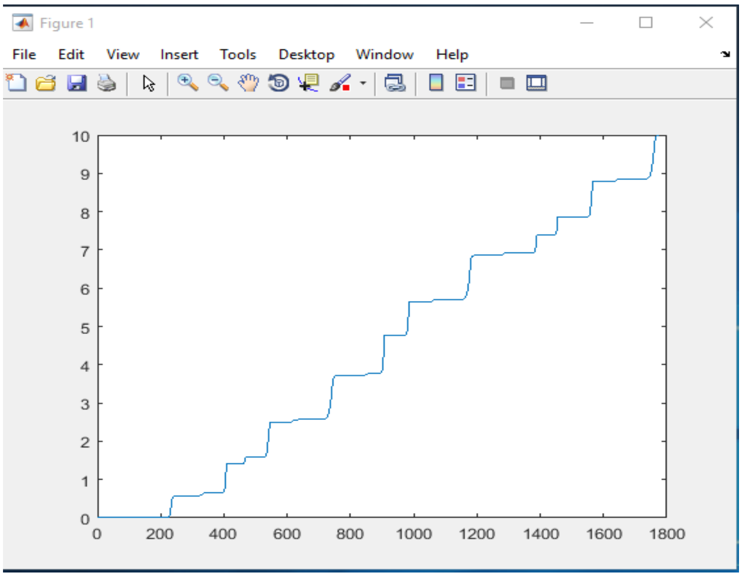


Figure 10: Frequency processing with Time

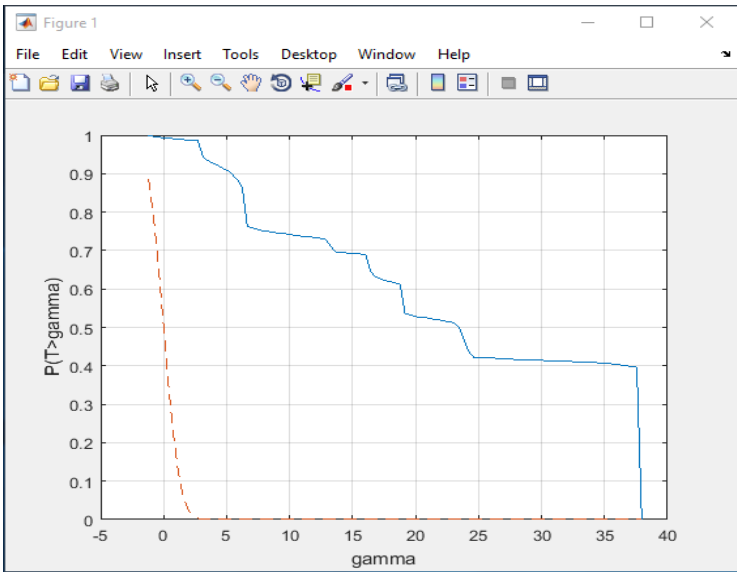


Figure 11: Thresholding vs. Gamma Correction

VI. CONCLUSION & FUTURE SCOPE

The photovoltaic (PV) energy effect can be considered an essential sustainable resource because of solar radiant energy abundance and the sustainability thus grid connected photovoltaic system is widely used, although solar energy is available abundantly and free of cost, the cost of the photovoltaic cells is very high. Hence the initial investment on solar energy will be very high. The basic element of a PV system is the solar cell which converts the solar irradiance into direct current. Grid interconnection of PV system requires an efficient converter to convert the low DC voltage into AC. The Gate Diffusion Input requires twin well CMOS or silicon on insulator (SOI) process for fabrication. Depending on the weather and the day time, the amount of electrical energy generated by the solar panels changes which is a problem for the system powered by photovoltaic systems. Grid-connected PV systems can cause problems on the grid, such as injecting more harmonics or reducing the stability. The main objective is to develop a power electronics interface for a three-phase grid connected PV with SIMULINK and Monte Carlo model. The current and voltage and to compare proposed working model with other existing models. Here the maximum current is produced along with voltage.

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