# MODELLING AND SIMULLATION OF GRID CONNECTED SYSTEM FOR EFFICIENT POWER MANAGEMENT

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**ABSTRACT**

Photovoltaic (PV) systems proposes attractive alternative source of generation because these can be placed near to the load centers when compared with other renewable source of generation. Most of renewable energy systems works in conjunction with the existing electrical grids. Also, inverter technology has an important role to have a safe and reliable grid interconnection operation of renewable energy systems. It is also necessary to generate a high quality power to the grid with reasonable cost. They also must be capable of provide high efficiency conversion with high power factor and low harmonic distortion. For this reason, the control policy must be considered. Therefore, The most important current control techniques are investigated in this paper. his project mainly focuses on the conversion of excessive solar energy into useful power to eliminate the power scarcity, where the solar power can be converted into electricity and can be synchronized with the grid. The solar power is trapped with the help of solar cells, which will produce a DC voltage. This DC voltage will be converted into AC using IGBT based three phase six pulse inverter. Filters are used to remove the higher order harmonics present in the signal inverter output signal. This filtered AC voltage can be synchronized with the grid.

**INTRODUCTION**

Solar energy is an important source of renewable energy and its technologies are broadly characterized as either passive solar or active solar depending on the way they capture and distribute solar energy or convert it into solar power. Active solar energy methods like the photovoltaic systems, concentrated solar power and solar water. Solar energy in one form or another is the source of nearly all energy on the earth. Passive solar like a building to the Sun, selecting materials with suitable thermal mass or light dispersing properties, and designing spaces which circulate air in the atmosphere. Photo Voltaic (PV) devices directly convert the incident solar radiation into electricity. It does this process with noiseless, pollution, makes them robust, reliable and long lasting. Photo voltaic is a simple and elegant method which harnesses the sun's energy.

**w**orld is moving towards the greener sources of energy to make the planet pollution free and environment friendly. The major utilization of these sources with grid integration is the challenging task. It is therefore Distribution Generation particularly single phase rooftop Photo Voltaic system are major research area for grid integration, since these sources have huge opportunity of generation near load terminal. The rooftop application involving single phase Distribution Generation's fed with Photo Voltaic source can be not only utilized for household use but the excess energy can be transferred to the grid through proper control scheme and adequate hardware.

Photo Voltaic systems can generate high voltages. Safety is therefore very important in order to avoid accidents and

damage of expensive components and equipment. For safety reasons, solar arrays are normally earthed, either by placing a matrix of metal in the ground under the array, or by using conventional earth rods. It is normally not necessary to protect solar array from direct lightning strikes, provided that their mounting structure is well earthed. However, inverters or other electronics controls connected to the array should be protected. Blocking diodes are installed in solar arrays to prevent reverse current flows into the modules, which may damage the modules and cause energy losses. By-pass diodes are incorporated into modules to prevent damage of arrays when some cells or modules become shaded. Photo Voltaic system requires regular maintenance to ensure proper operation and the full life of components. Some of the most important maintenance tasks are cleaning of modules front, Removal obstacles, tree branches, etc. Which cause shadowing of the modules, Battery charge check, if it remains very low the system should be re-designed, topping of battery electrolyte.

**SIMULATION RESULTS**

New battery technologies are constantly being explored that can offer better energy-to-weight ratios, lower costs and increased battery life. The nickel-metal-hydride battery has received a great deal of attention as a near future solution. Nickel-metal-hydride batteries offer about twice the energy capacity for the same weight as a current lead-acid battery. Another battery type with an even greater energy density is Lithium ion. Solar power is currently been used in many commercial applications such as solar water heaters, solar pumps, stand-alone solar powered houses etc. The extensive power of the Sun can be used for power generation with the help of solar cells. The power demand in our country is at its peak level and will tend to increase in the upcoming days. This project mainly focuses on the conversion of excessive solar energy into useful power to eliminate the power scarcity, where the solar power can be converted into electricity and can be synchronized with the grid. The solar power is trapped with the help of solar cells, which will produce a DC voltage. This DC voltage will be converted into AC using IGBT based three phase six pulse inverter. Filters are used to remove the higher order harmonics present in the signal inverter output signal. This filtered AC voltage can be synchronized with the grid through Phase Locked Loop (PLL) base control system.

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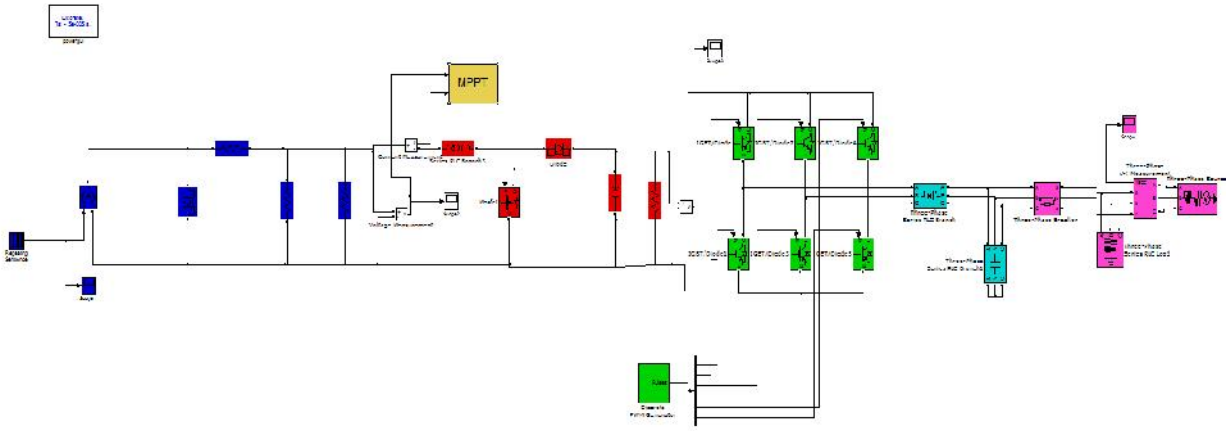

**Fig 1 Simulink model for PV system integrated with grid using constant current controller**

Simulink is a software package for modeling, simulating, and analyzing dynamical systems. It supports linear and nonlinear systems, modeled in continuous time, sampled time, or a hybrid of the two. For modeling, Simulink provides a graphical user interface (GUI) for building models as block diagrams, using click-and-drag mouse operations. Models are hierarchical, so we can build models using both top-down and bottom-up approaches. We can view the system at a high level, then double-click on blocks to go down through the levels to see increasing levels of model detail. This approach provides insight into how a model is organized and how its parts interact. After we define a model, we can simulate it, using a choice of integration methods, either from the Simulink menus or by entering commands in MATLAB's command window. Using scopes and other display blocks, we can see the simulation results while the simulation is running. In addition, we can change parameters and immediately see what happens, for "what if" exploration.

A grid-connected power system is connected to the utility grid which generates solar PV. A grid connected system consists of solar panel, power condition unit, electronic converters and grid synchronizer. It also includes integrated battery. Based on their utility they are classified into small residential to commercial rooftop. It gets connected to the utility grid and perfectly connected it supplies excessive power. Photovoltaic wattage may be less than average consumption, whereas the consumer will purchase grid energy. They can feed excess power to the grid A meter is fixed to monitor the transfer of power is done through feedback. Gridconnected rooftop systems which have a capacity less than 10 kilowatts can meet the load of most consumers. Depending on their expectation with their local grid energy company, the consumer needs to pay the cost of electricity which is consumed less the value of electricity generated. This will be a negative number if more electricity is generated than consumed by the company

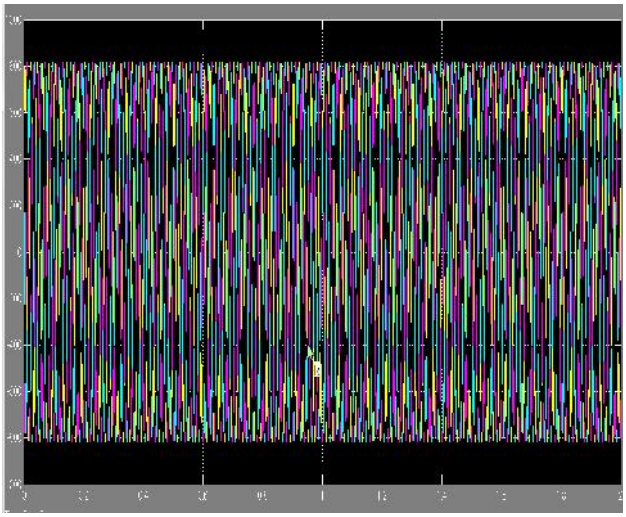

Fig 2 Voltage with r load

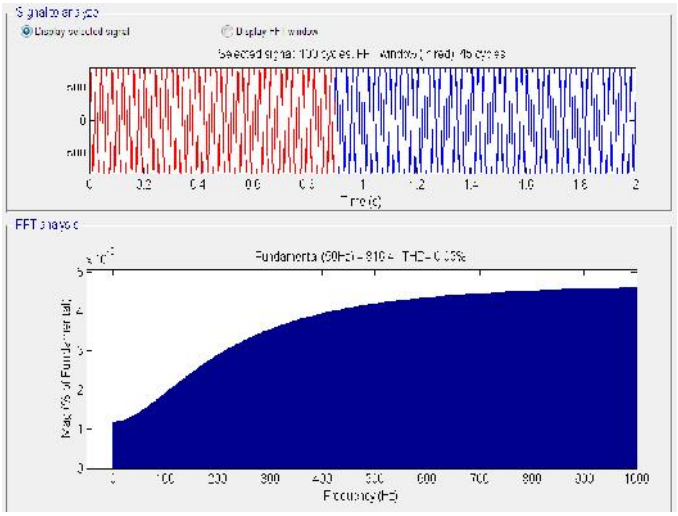

Fig 3 Total harmonic distortion for r load

Solar power is currently been used in many commercial applications such as solar water heaters, solar pumps, stand-alone solar powered houses etc. The extensive power of the Sun can be used for power generation with the help of solar cells. The power demand in our country is at its peak level and will tend to increase in the upcoming days. This project mainly focuses on the conversion of excessive solar energy into useful power to eliminate the power scarcity, where the solar power can be converted into electricity and can be synchronized with the grid. The solar power is trapped with the help of solar cells, which will produce a DC voltage. This DC voltage will be converted into AC using IGBT based three phase six pulse inverter. Filters are used to remove the higher order harmonics present in the signal inverter output signal. This filtered AC voltage can be synchronized with the grid through Phase Locked Loop (PLL) base control system.

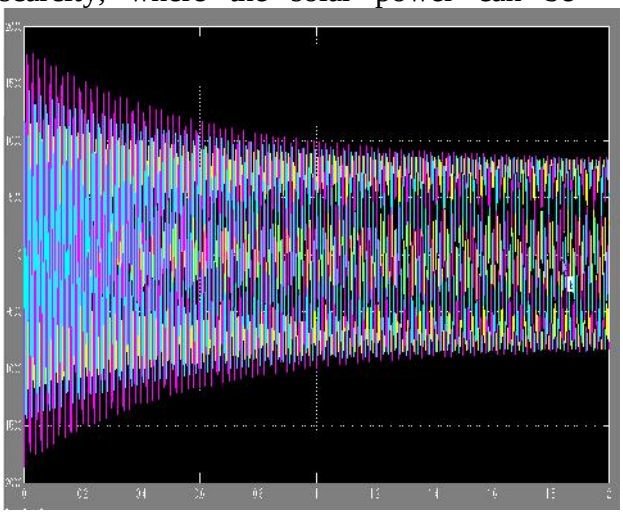

Fig 4 Voltage with rl load

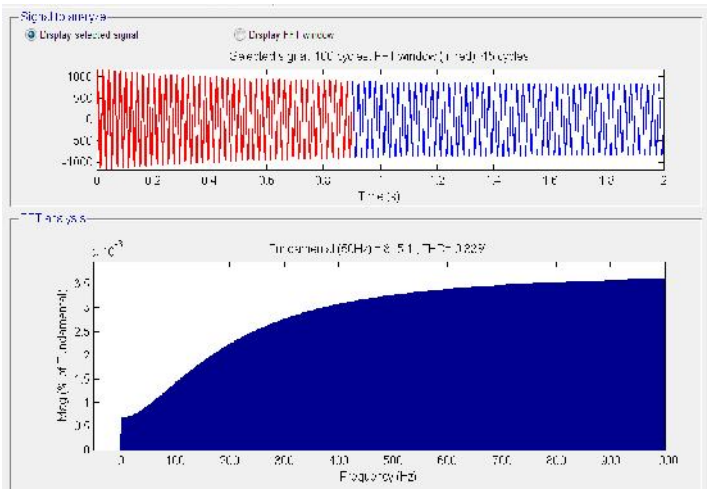

Fig 5 Total harmonic distortion for rl load

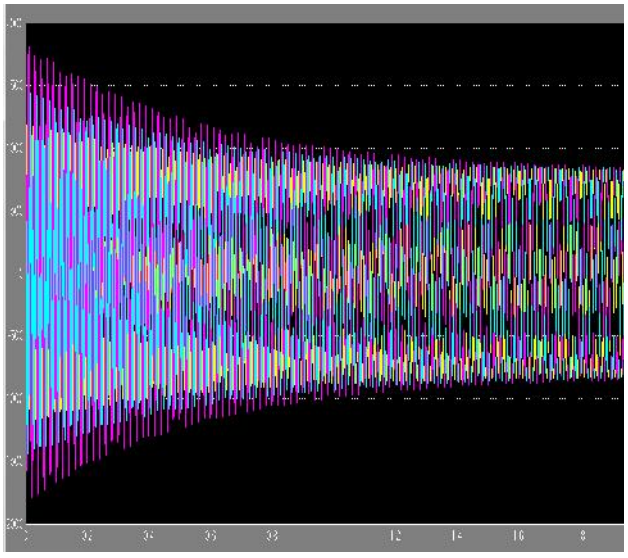

Fig 6 Voltage with rlc load

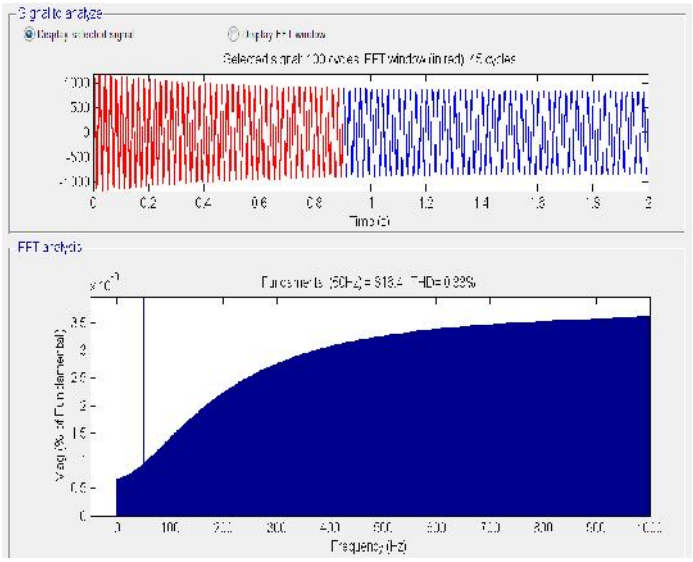

Fig 7 Total harmonic distortion for rlc load

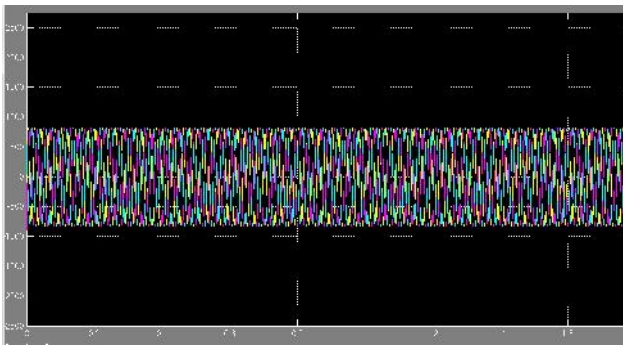

Fig 8 Voltage with RC load

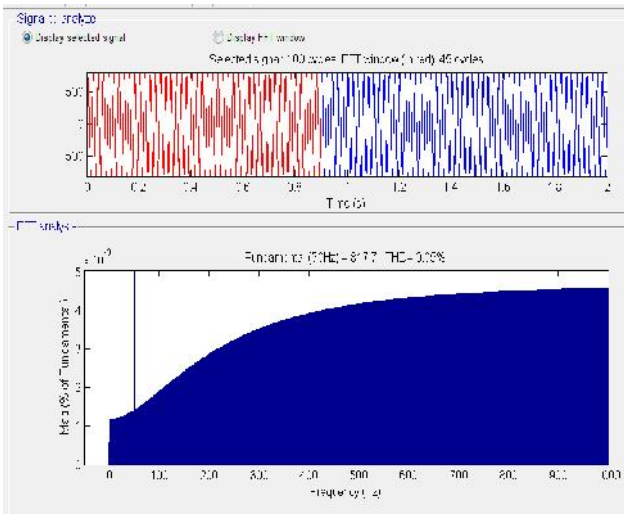

Fig 9 Total harmonic distortion for RC load

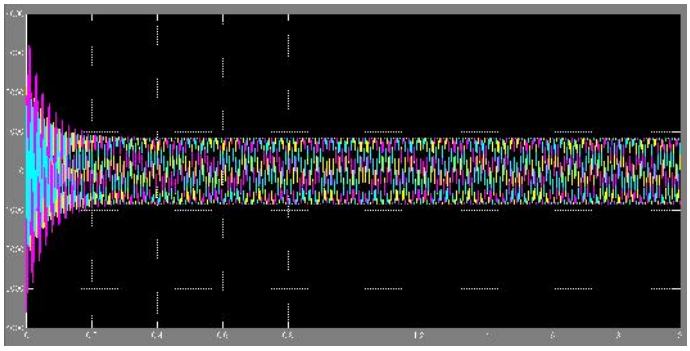

Fig 10 Voltage with RLE load

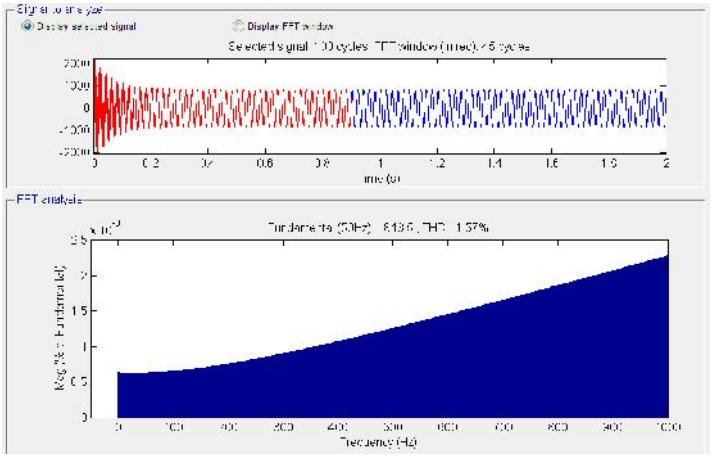

Fig 11 Total harmonic distortion for RLE load

The simulation results can be put in the MATLAB workspace for post processing and visualization. Simulink can be used to explore the behavior of a wide range of real-world dynamic systems, including electrical circuits, shock absorbers, braking systems, and many other electrical, mechanical, and thermodynamic systems.

Simulating a dynamic system is a two-step process with Simulink. First, we create a graphical model of the system to be simulated, using Simulink's model editor. The model depicts the time-dependent mathematical relationships among the system's inputs, states, and outputs. Then, we use Simulink to simulate the behavior of the system over a specified time span. Simulink uses information that you entered into the model to perform the simulation

**CONCLUSION**

The circuit can synchronize an inverter to the grid and also can re-gain synchronization and its phase, amplitude, or distortion of the grid voltage. Solar power is currently been used in many commercial applications such as solar water heaters, solar pumps, stand-alone solar powered houses etc. The extensive power of the Sun can be used for power generation with the help of solar cells. The power demand in our country is at its peak level and will tend to increase in the upcoming days. This project mainly focuses on the conversion of

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