

# Power Quality Enhancement using Photovoltaic based Dynamic Voltage Restorer

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**ABSTRACT:** This energy explains the built-in photovoltaic based dynamic voltage restorer (DVR) for improvement of voltage droop along the engage mitigation. Photo Voltaic (PV) model, DVR model and local grid model are implemented and the results of simulation are presented. In order to progress the competence of the PV system Incremental Conductance (INC) algorithm base Maximum Power Point Tracker (MPPT) is connected. The cascaded H-bridge multilevel inverter is used for exchange of actual and rash power to the sensitive load from PV system. Modeling of the proposed system was developed by MATLAB Simulink. The purpose of the proposed system is to system activities, which allows the renewable energy sources for justifying voltage disturbances.

**KEYWORDS:** component: Dynamic Voltage Restorer, Maximum Power Point Tracker, sliding mode controller, H-bridge multilevel inverter

## I. INTRODUCTION

Between the existing control methods of DVR, the SMC technique has its high unfussiness and robustness. A sliding mode input-output linearization controller for the zero-voltage switching (ZVS) is presented. The proposed controller expansively improves the momentary response and disturbance, rejection of the converter while defend the closed-loop stability and SMC develop alternating control laws to drive the system state path onto a specified surface in the status break, the so called sliding or switching surface, and to remain the system state on this assorted for all the subsequent times.

The key trouble in power system is voltage wilt and engage, voltage flicker, transient. DVR is one of the devices that have a similar structure of string type of FACTS device. The impact of this device is to guard a sensitive load from wilt or swell and deviations in the supply side by quick succession voltage booster to remunerate for the fall or grow in the supply voltage. When there is a warp in the source voltage, the proposed series device may also have to infuse a distorted voltage to neutralize the harmonic voltage.

Photo voltaic systems can engender direct current electricity without environmental impact and contagion when exposed to solar radiation. Newly many new methods are proposed for modeling and simulation of photovoltaic arrays (PVA) having superior accuracy and lower assumptions. Being a semiconductor device, the PV system is stagnant, quiet, free of moving parts, and has little function and maintenance costs. But due to relatively high initial cost and low efficiency, maximum power point tracking (MPPT) is critical. Hence many literatures have dealt on MPPT. For the effective integration of the solar power into the power system, excellent controlling methods should be developed using power electronics devices. In this method PV power generation system is use as energy source for DVR, when disorder occurs and any other disorder time it will supply power to plunk loads. It occurs through different converter topologies. This model of a multilevel converter to realize advanced power is to use a series of power semiconductor switches with some lesser number of voltage dc sources, which is most right for the proposed system collecting power from PV.

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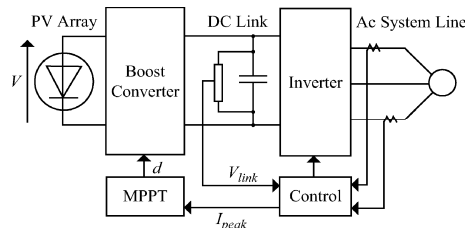


Figure: 1 Topology for dc-link capacitor droop control

Following the maximum power point (MPP) of a photovoltaic (PV) array is frequently an essential part of a PV system. As such, many MPP tracking (MPPT) methods have subsisted developed and executed. The methods vary in complexity, sensors required, junction speed, cost, range of effectiveness, implementation hardware, popularity, and in other respects. They range from the almost noticeable (but not necessarily ineffective) to the most creative (not necessarily most effective). In fact, so many methods have been developed that it has become difficult to sufficiently determine which method, newly proposed or existing, is most suitable for a given PV system. Given the large number of methods for MPPT, an analysis of the methods would be very positive to researchers and practitioners in PV systems.

## II. MAXIMUM POWER POINT TRACKING

It is a performance that grid connected inverters, solar battery chargers and parallel devices use to get the maximum possible power from one or more photovoltaic devices, naturally solar panels, though optical power transmission systems can gain from similar technology.

Solar cells have a composite relationship among the solar irradiation, temperature and total resistance that produces a non-linear output efficiency which can be explore based on the I-V curve. It is the function of the MPPT system to sample the output of the cells and apply the right resistance (load) to attain maximum power for any given ecological conditions. MPPT devices are typically integrated into an electric system that offered voltage or current conversion, filtering, and directive for driving various loads, including power grids, batteries, or motors.

### BLOCK DIAGRAM:

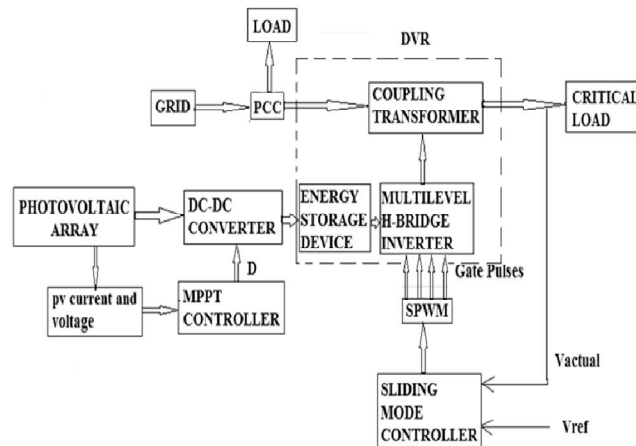


Figure: 2 Block Diagram of proposed system

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### I-V curve

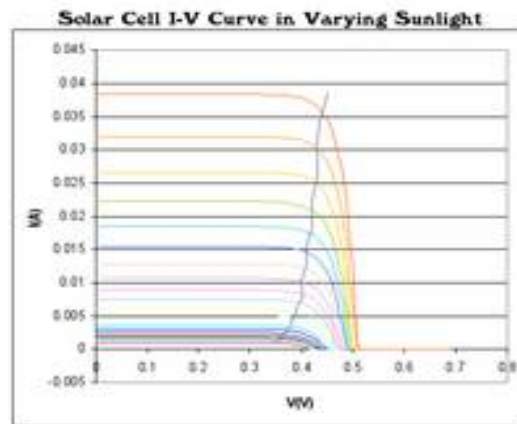


Figure: 3 Curve –I

The occasion of multiple local maxima due to fractional shading of the PV array(s) can be a real encumbrance to the proper functioning of an MPP tracker. Significant power loss can be deserved if a local maximum is tracked instead of the real MPP. As declared previously, the modern sweep and the state based methods should track the true MPP even in the presence of multiple local maxima. Yet, the other methods entail an additional initial stage to bypass the surplus local maxima and bring operation to close the real MPP

### E. APPLICATIONS

Different MPPT techniques argued earlier will suit diverse applications. For example, in space satellites and orbital stations that absorb large amount of money, the costs and complexity of the MPP tracker are not as important as its concert and reliability. The tracker should be able to constantly track the true MPP in minimum amount of time and should not involve periodic tuning. Fuzzy logic control, neural network, and RCC are superior options in this case. While the load in solar vehicles consists mainly of batteries, load current or voltage maximization should also be measured. The goal when using PV arrays in built-up areas is to minimize the payback time

### ENERGY STORAGE DEVICES

Energy storage entity is responsible for energy storage in DC form, Super-Capacitors, Superconducting Magnetic Energy Storage (SMES), lead acid batteries and Flywheels are commonly used as energy storage devices. In proposed model energy generated from PV is stored in SMES and deliver to DVR at the time of unavailability of solar irradiation.

### DYNAMIC VOLTAGE RESTORER (DVR)

DVR is the most proficient and successful modern norm power device used in power distribution networks. Frequently it is installed in a distribution system among the supply and the load feeder at the point of common coupling (PCC). In accumulation to reducing voltage dip and engorge, DVR can also make sure of transient in voltage, line voltage harmonics mitigation and fault current margins.

### PHOTOVOLTAIC MODULE:

A solar panel is enclosed interconnected assembly of solar cells, also known as photovoltaic cells. The solar panel is used as a component in a better photovoltaic system to suggest electricity for commercial and residential applications.

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Since a single solar panel can only generate a limited amount of power, many installations contain several panels. This is known as a photovoltaic array. A photovoltaic installation typically embraces an array of solar panels, an inverter, batteries and interconnection wiring.



**Figure:4 Solar Panel**

Solar panels utilize light energy (photons) from the sun to produce electricity through the photovoltaic effect. The structural (load carrying) member of a element can either be the top layer (superstrate) or the back layer (substrate). The mainstream of the modules use wafer-based crystalline silicon cells or a thin-film cell based on cadmium telluride or silicon. Crystalline silicon, which is frequently used in the wafer form in photovoltaic (PV) modules, is consequent from silicon, a commonly used semi-conductor.

A solar cell or photovoltaic cell is a wide area electronic device that converts solar energy into electricity by the photovoltaic effect. Photovoltaic is the field of machinery and research interrelated to the application of solar cells as solar energy. Occasionally the term solar cell is reserved for devices planned specifically to capture energy from sunlight, while the term photovoltaic cell is used when the source is vague. Assemblies of cells are used to make solar modules, or photovoltaic arrays. This is especially important for wafer-based silicon cells which are frail. Sheltered from moisture, which corrodes metal contacts and interconnects, (and for thin-film cells the transparent conductive oxide layer) thus diminishing performance and lifetime. Most modules are regularly rigid, but there are some flexible modules available, based on thin-film cells.

Electrical connections are made in series to attain a desired output voltage and/or in parallel to provide a beloved amount of current source capability. Diodes are integrated to avoid overheating of cells in case of partial shading. Since cell heating reduces the operating efficiency it is enviable to minimize the heating. Very few modules incorporate any design features to reduce temperature; yet installers try to afford good ventilation behind the module

New designs of module include concentrator modules in which the glow is determined by an array of lenses or mirrors onto an array of small cells. It allows the use of cells with a very high-cost per unit area (such as gallium arsenide) in a cost-competitive manner.

The photovoltaic can cover a array of frequencies of light and can produce electricity from them, but occasionally cannot cover the entire solar spectrum (particularly, ultraviolet, infrared and low or diffused light). Hence much of incident sunlight energy is worn out when used for solar panels, although they can give far higher efficiencies if clarify with monochromatic light. Another design concept is to split the light into different wavelength ranges and direct the beams onto different cells tuned to the fitting wavelength ranges. Also, the use of infrared photovoltaic cells can amplify the efficiencies, producing power at night.

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## III. SIMULATION RESULTS

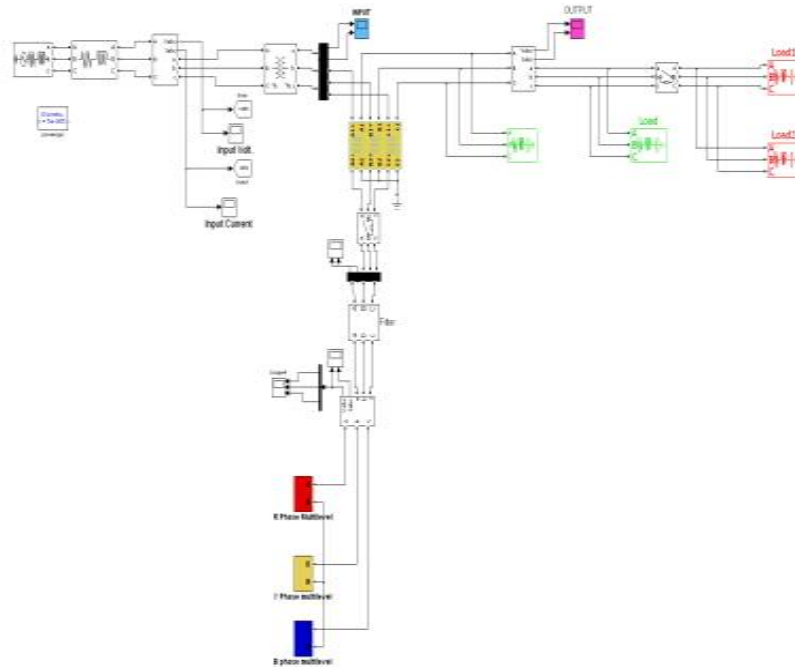


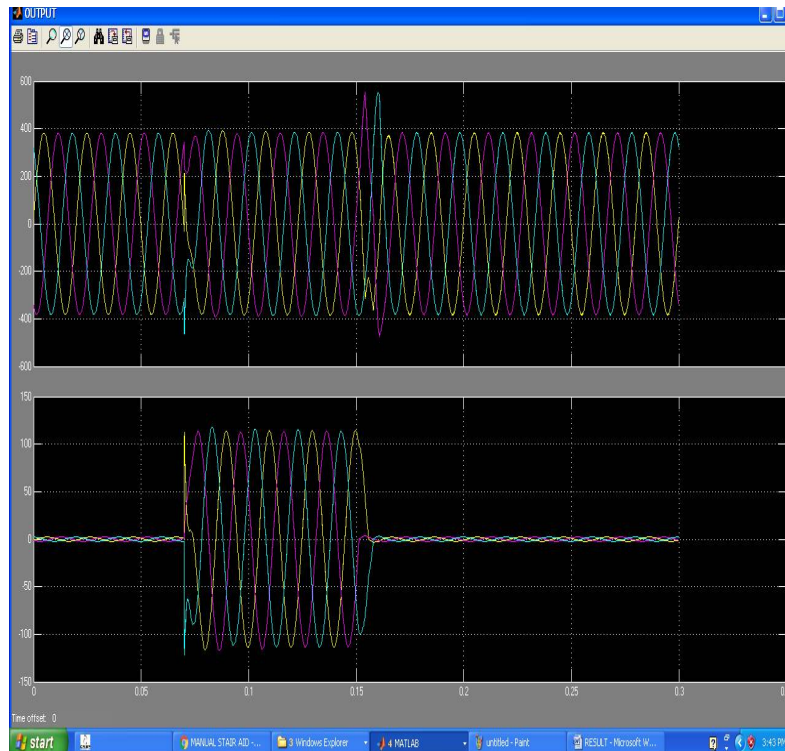
Figure: 5 Simulation Diagram

### OUTPUT WITHOUT DVR



Figure: 6 Output without DVR

**OUTPUT WITH DVR**



**Figure:7** Output with DVR

**IV. CONCLUSION**

In this result, the reputation of voltage in the distribution side was superior with the help of DVR, when the disturbance occurs in sensitive load feeder. Examination was carried out to various custom power devices, DVR having excellent damages for voltage disturbances. Simulation was carried out with PV interfaced multilevel converter based DVR employing sinusoidal PWM technique with MATLAB/SIMULINK software. Many paper worked on voltage improvement for sag or swell, but in the proposed model both are mitigated either required. To further boosts up the function of a DVR, we imply a few techniques. As the number of levels in a multilevel inverter raise, we can ensure harmonic free sinusoidal output, but the cost increases as the stage increases. But, by means of fuzzy based controller for space vector PWM technique to impel the power switches in an inverter we can get the desired results for non-linear loads. Although it is a PV with MPPT algorithm included this techniques into a DVR can greatly recover its performance and ensure reliable operation of the sensitive loads.

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