ST MARY'S GROUP OF INSTITUTIONS GUNTUR
CHEBROLU(V&M),GUNTUR DT-522212

❑ UNDER THE GUIDELINES OF

MR P.LASHMI NARAYANA. M.TECH

❑ TEAM SODALES

- **SHAIK.KHASIM PEERA (19BJ1A0236)**
- **T.SAI HARI HARA CHANDRA (19BJ1A0240)**
- **SHAIK.MABU SUBHANI (19BJ1A0237)**
- **S.MAHENDRA (19BJ1A0233)**
- **A.MANOJ KUMAR (19BJ1A0202)**
- **M. SUDHAKAR(19BJ1A0221)**

Active and Reactive Power Control in Three Phase Solar PV Inverter using Modified IC Method

❑ *CONTENTS*

❑ABSTRACT

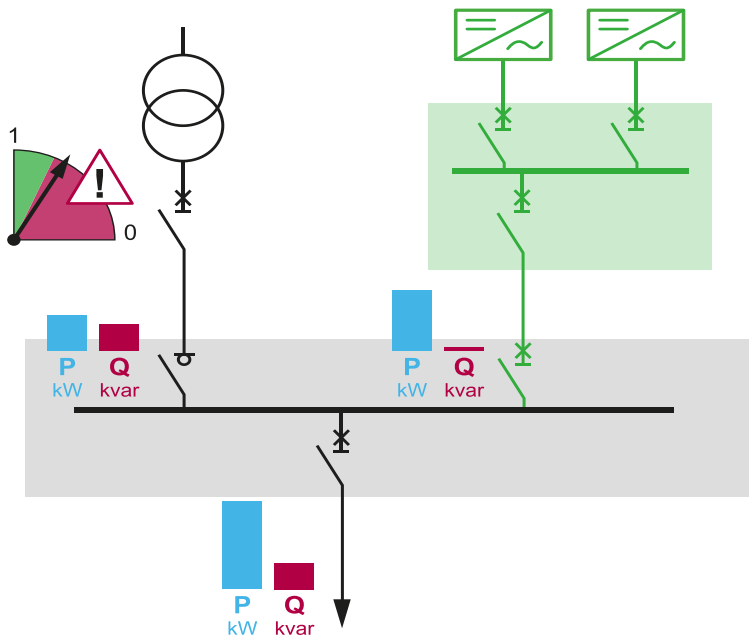
- The active and reactive power fed to the grid from the solar inverter are need to be controlled.
- The regulation of active power from solar inverter is performed by modifying maximum power point tracking algorithm(MPPT) of photovoltaic generation and run in off maximum power mode.
- To corporate the solar plant off maximum power mode, fractional voltage based modified incremental conductance method is used.

❑ INTRODUCTION

- Photovoltaic system are widely used in many fields such as interactive inverters, irrigation System ,house buildings aways from the grid, space vehicles and military application
- The efficiency of the panels is low depending on the environment factors such as temperature variation level ,shading and dirt.
- The non-uniform nature of power generation directly affects voltage regulation and creates voltage distortion in the power system.
- This efficiency is also reduced due to variable loads of the grid.

- There it becomes important to transfer maximum available power from PV panels to the grid
- To control this penetration level of solar PV, maximum power point tracking (MPPT) algorithm is needed to be modified.
- Modification in MPPT is performed by operating in off-MPPT mode.
- This modified MPPT is control is based on modified incremental conductance (IC) method for fractional voltage change is introduced.

❑ Need of Control Active and Reactive power

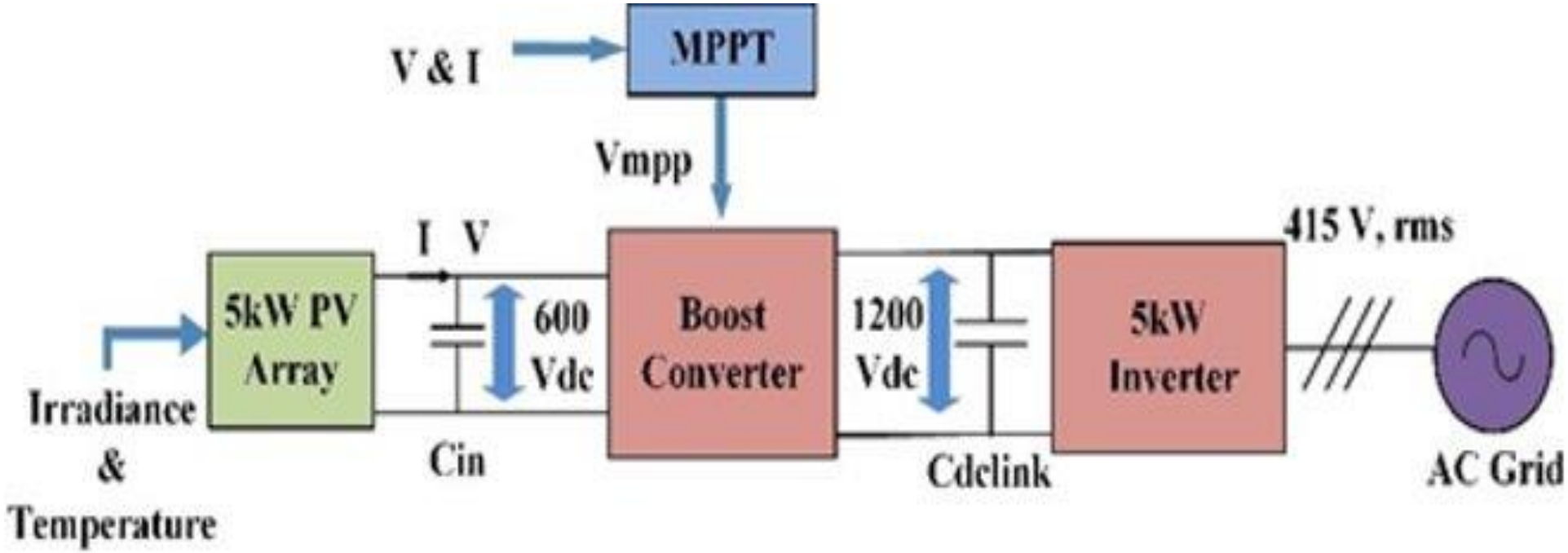


- The solar production providing active power only by default there is no reactive power

  P(kw)/s(kVA)=**POWER FACTOR**

- The energy providers required a power factor higher then threshold such as 0.9 or 0.95
- At the point of connection to the network below the threshold penalties are billed to the end user
- Then by controlling active and reactive power providing appropriate set point value of solar inverter to avoid power factor penalties

❑ PROPOSED SYSTEM



❑ COMPONENTS OF PROPOSED SYSTEM

- ➢ 5KW PV ARRAY
- ➢ BOOST CONVERTER
- ➢ MAXIMUM POWER POINT a(MPPT)
- ➢ 5KW INVERTER
- ➢ AC GRID

❑ 5KW PV ARRAY

- A photovoltaic array is a multiple solar panels electrically wired together to form a much larger PV installation called an array
- A 5kw is made up of 20 solar panels assuming that the panels have 250-watt capacity(ELDORA 250)

Peak Power Pmax (Wp)	250	252.5	255	257.5	260	262.5	265
Maximum Voltage Vmpp (V)	30.6	30.7	30.8	30.9	31.0	31.1	31.2
Maximum Current Impp (A)	8.18	8.23	8.29	8.34	8.40	8.45	8.50
Open Circuit Voltage Voc (V)	37.5	37.5	37.6	37.7	37.8	37.9	38.0
Short Circuit Current Isc (A)	8.70	8.76	8.82	8.89	8.95	8.98	9.00
Module Efficiency η (%)	15.4	15.5	15.7	15.8	16.0	16.1	16.3

❑ BOOST CONVERTER

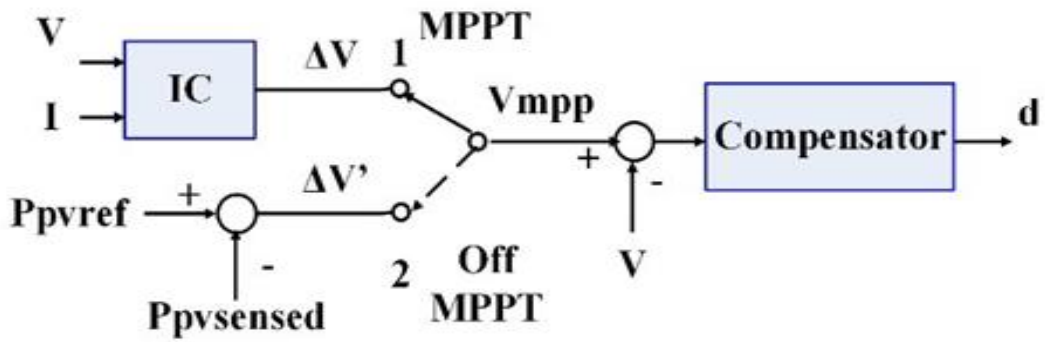
- A Boost converter is used as DC-DC converter inside the three phase inverter. Boost converter's inductor L* and input capacitance Cin are calculated considering 1% current ripple and 10% voltage ripple respectively. DC link capacitor of boost converter C dc link is calculate d considering 1% voltage ripple
- The boost converter parameters are

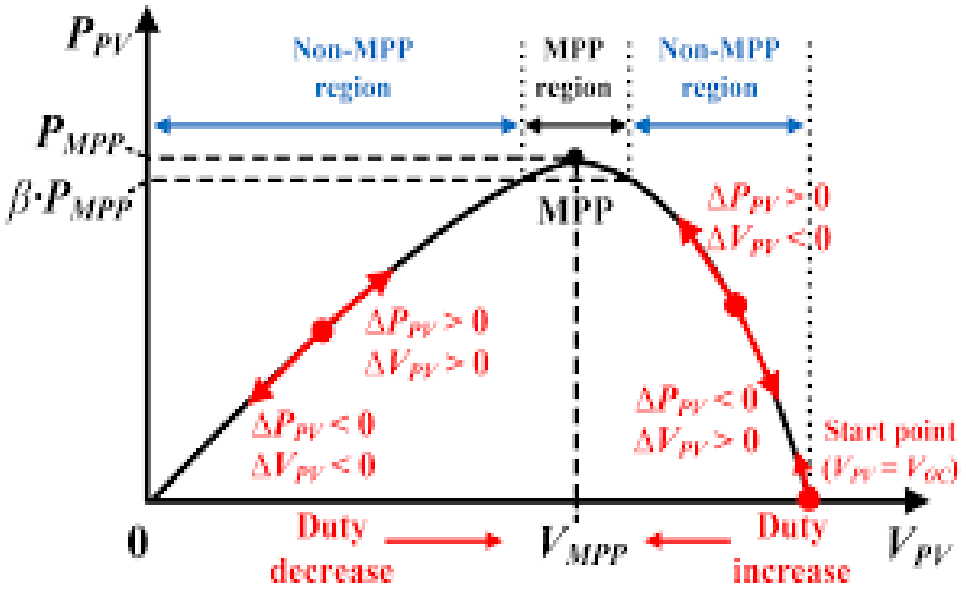
BOOST CONVERTER PARAMETERS	VALUES
Cin Input capacitance	125 uF
L* inductor	30mH
C dc link DC capacitor	1000 uF
MOSFET switching frequency	20kHz
Vin Input voltage to boost converter are STC	600 V
V dc link DC link/Output voltage from boost converter	1200 V

❑ MMPT Algorithm

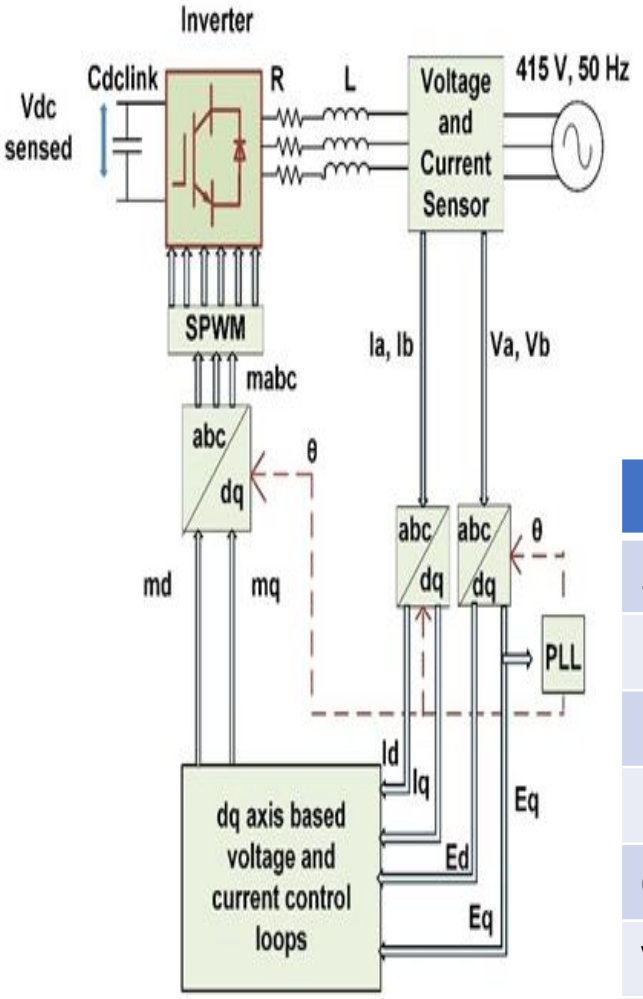
- Maximum power point tracking (MPPT) is an algorithm implemented in photovoltaic (PV) inverters to continuously adjust the impedance seen by the solar array to keep the PV system operating at, or close to, the peak power point of the PV panel under varying conditions, like changing solar irradiance, temperature, and ..
- IC method is used to track the maximum power point voltage. IC will generate change of voltage *ΔV* from solar array. Thise *ΔV is* changed until conductance becomes zero and the maximum power and maximum voltage are found.
- If PV power increases from the reference power. From the reference voltage changed *ΔV '* will be generated and it will be reduced the MPP voltage to off-MPP voltage

$$I / V + dI / dV = 0 \quad (or) \quad I + V\, dI / dV = 0$$





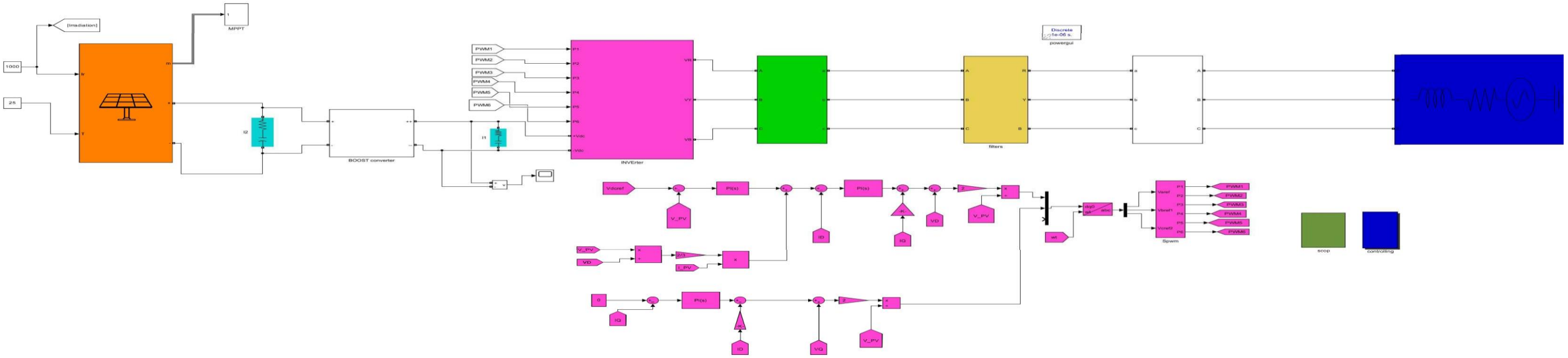
❑ 5KW INVERTER



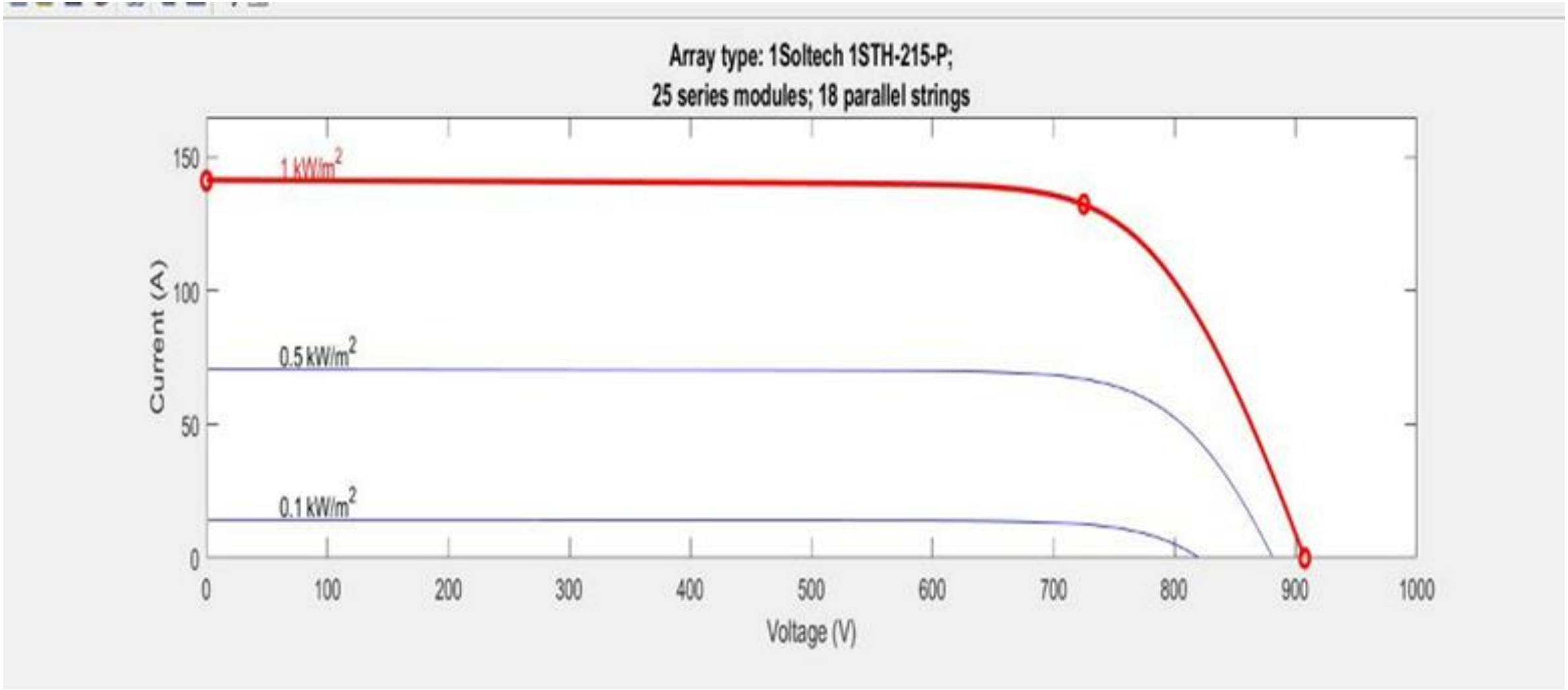
- The data sheet of KACO TL 5.0 is referred while modeling PWM inverter.
- Here dq-axis based synchronous reference frame control is utilized for inverter control. This synchronous reference frame based control provides simple and independent control active and reactive power of inverter

Parameters	Values
3 phase grid voltage and frequency	415 V rms, 50 Hz
L, filter inductor	10.96 mH
R, Ac side resister	1.7225 OHM
M1, Modulation index	0.85
Current controller parameters	Kp=5.48, Ki=861.25
Voltage controller parameters	Kp=0.1568, Ki=11.09
Switching frequency	10 kHz

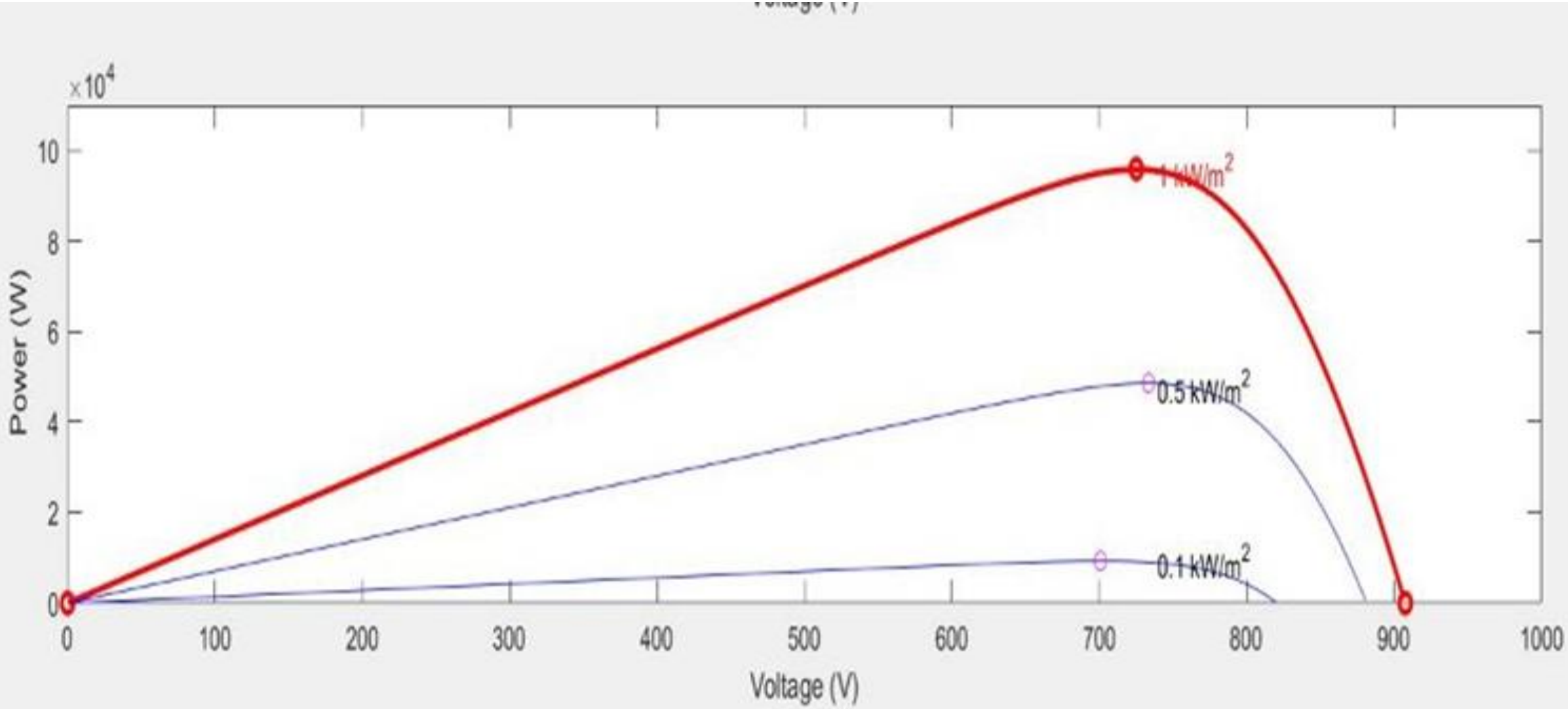
❑ PRAPOSED SYSTEM SIMULATION



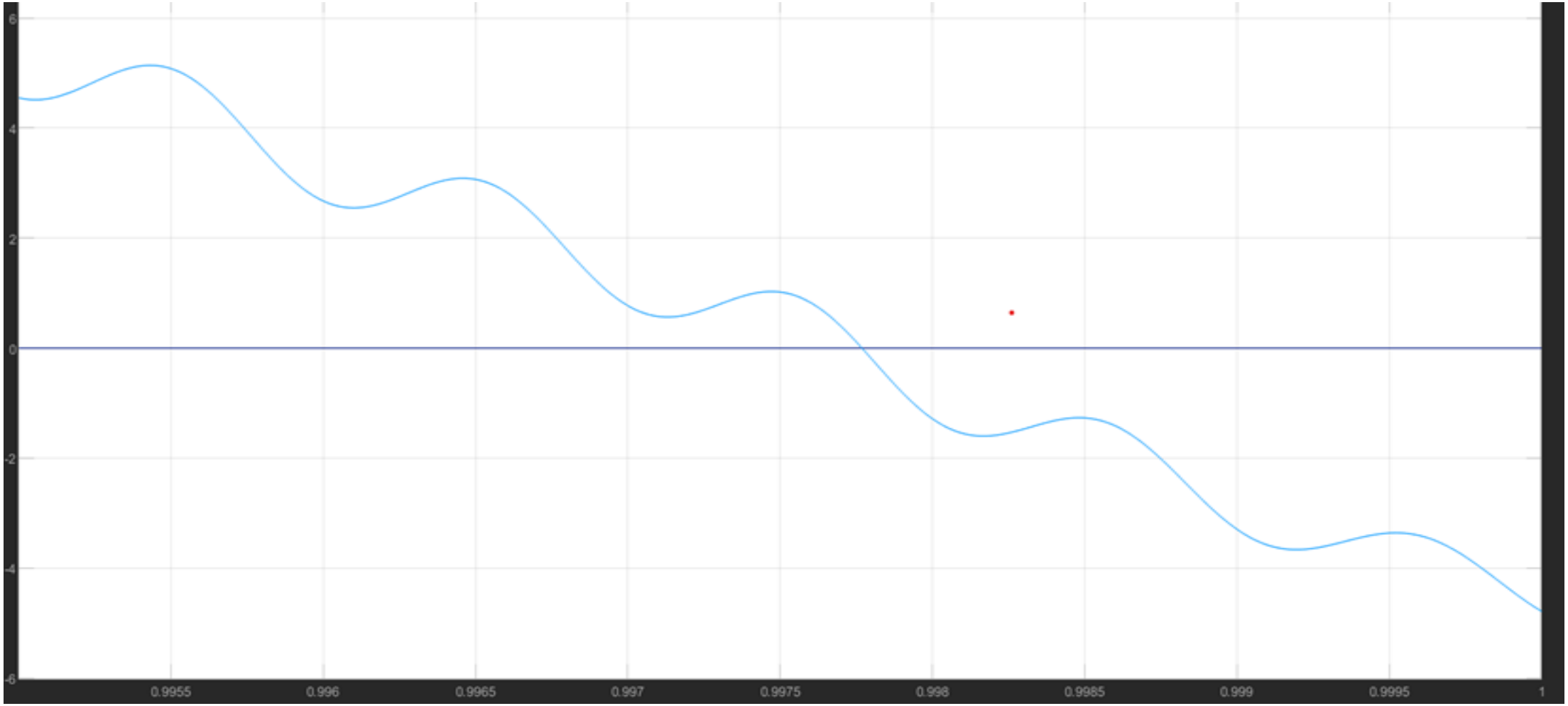
❑ IRRADIATION AT DIFFERENT VOLTAGES AND CURRENTS



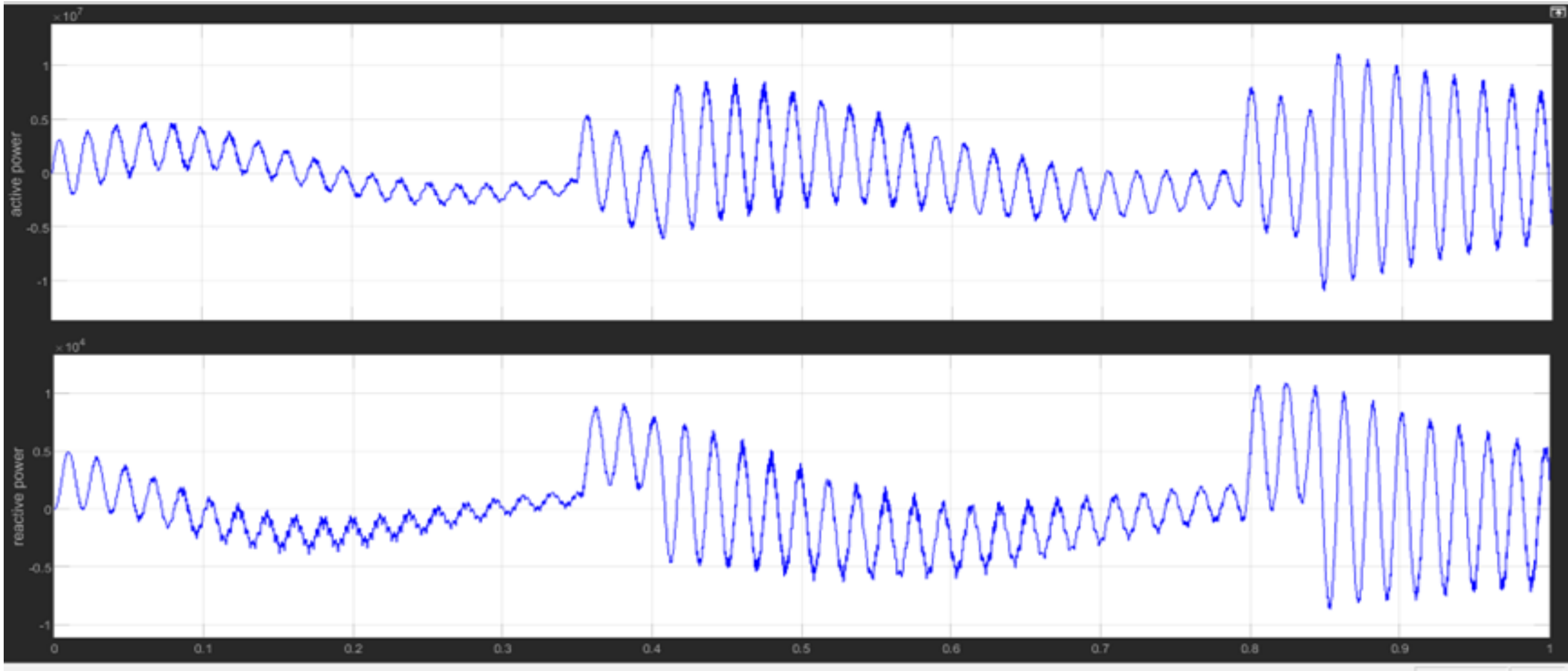
❑ IRRAADIATION AT DIFFERENT VOLTAGES AND CURRENTS



❑ ACTIVE POWER WITH RESPECT TO TEMPERATURE



❑ ACTIVE AND REACTIVE POWER CONTROL



❑ADVANTAGES

- With this we can provide active power control reactive power control is simulated on unit, lagging and leading PF.
- With this the operators by increasing load capability and reducing power losses and improving voltage.
- PV provide a suitable energy source for remote (either cold or more temperate)regions with no other electricity.

❑APPLICATIONS

- Telecommunication repeater stations.
- Cottages and remote residences.
- Parks in remote regions.
- Supply the occasional power.

❑CONCLUTION

- More over due to high penetration level solar PV, grid voltage and power fluctuation degrade the grid stability.
- To address the concerning issue the active power injected from solar inverter should be regulated

❑ Future scope

- Here in this project we are using PI-controller in current control loop and voltage control loop for current control parameters and voltage control parameters.
- For future implementation PID-controller can provides better current control parameters and voltage parameters.

❑ REFERENCES

- "Energy Statistic 2016", Central Statistics Office, Ministry of Statistics and Program Implementation, Government of India, www.mospi.gov.in.
- German Federal Law: Renewable Energy Sources Act, BGNI, Std., July, 2014.
- Energinet.dk, "Technical regulation 3.2.2 for PV power plants with a power output above 11 kW", Tech. Rep. 2015.
- Y. Yang. H. Wang, F. Blaabjerg, and T. Kerekes, "A hybrid power control concept for PV inverters with reduced thermal loading", *IEEE Transaction on Power Electronics*, vol. 29, no. 12, pp. 6271-6275, December, 2014.

- *EL FIN [THE END]*

- ***THANK YOU***