SYLLABUS

OBJECTIVES:

1. To train the students in Renewable Energy Sources and technologies.
2. To provide adequate inputs on a variety of issues in harnessing Renewable Energy.
3. To recognize current and possible future role of Renewable energy sources.

LISTOFEXPERIMENTS

1. Simulation study on Solar PV Energy System.
2. Experimenton“VI-CharacteristicsandEfficiencyof1kWpSolar PV System”.
3. Experiment on “Shadowing effect & diode based solution in1kWp Solar PV system”.
4. Experiment on Performance assessment of Grid connected and Standalone 1kWp Solar Power System.
5. Simulation study on Wind Energy Generator.
6. Experiment on Performance assessment of micro Wind Energy Generator.
7. Simulation study on Hybrid(Solar-Wind)Power System.
8. Experiment on Performance Assessment of Hybrid (Solar-Wind) Power System.
9. Simulation study on Hydel Power.
10. Experiment on Performance Assessment of100WFuel.

ADDITIONAL EXPERIMENTS:

11. Simulation study on Intelligent Controllers for Hybrid Systems.

LISTOF EXPERIMENTALSETUP

ICYCLE:

1. Simulation study on Solar PV Energy System.
2. Experiment on “VI-Characteristics and Efficiencyof 1kWp Solar PV System”.
3. Experiment on “Shadowing effect & diode based solution in1kWp Solar PV System”.
4. Experiment on Performance assessment of Grid connected and Standalone 1kWpSolar Power System.
5. Simulation study on Wind Energy Generator.

IICYCLE:

6. Experiment on Performance assessment of micro Wind Energy Generator.
7. Simulation study on Hybrid (Solar-Wind) Power System.
8. Experiment on Performance Assessment of Hybrid (Solar-Wind) Power System.
9. Simulation study on Hydel Power.
10. Experiment on Performance Assessment of100WFuel Cell.
11. Simulation study on Intelligent Controllers for Hybrid Systems.

CONTENTS

CONTENTS

S.No	Date	Name of the Experiment	Marks	Signature
		Average Marks		

Ex.No:1

Simulation study on Solar PV Energy System

Date:

AIM:

To study PV energy system using MATLAB Simulink software.

APPARATUS REQUIRED:

S.No	Name of the Apparatus	Range	Quantity
1.	Simulation software(MATLAB Simulink)		

THEORY:

Photovoltaic (PV) power generation is a reliable and economical source of electricity in rural areas. It is important to operate the PV energy conversion systems near the maximum power point (MPP) to increase the efficiency of the PV system. But the solar energy always varies instantaneously and the current and power of PV array varies non-linearly with the terminal voltage, solar radiation, and temperature. So, the maximum power output cannot be easily obtained. As solar photovoltaic cells have significant nonlinear output characteristic, the photoelectric conversion efficiency is still very low. Therefore, so far the research of output characteristics of photovoltaic cells is an important topic in the industry. This paper proposes a mathematical model of PV array based on the principle of photovoltaic cells and establish the simulation model in Simulink. The output characteristic curve of the photovoltaic cells is obtained with different solar radiation and temperature. Thus, it can lay the foundation for in the following research of the maximum power point tracking

PROCEDURE:

1. MATLAB Simulink model file is created.
2. Using Simulink library pv model generated.
3. Scope is verified for different values of V&I values.

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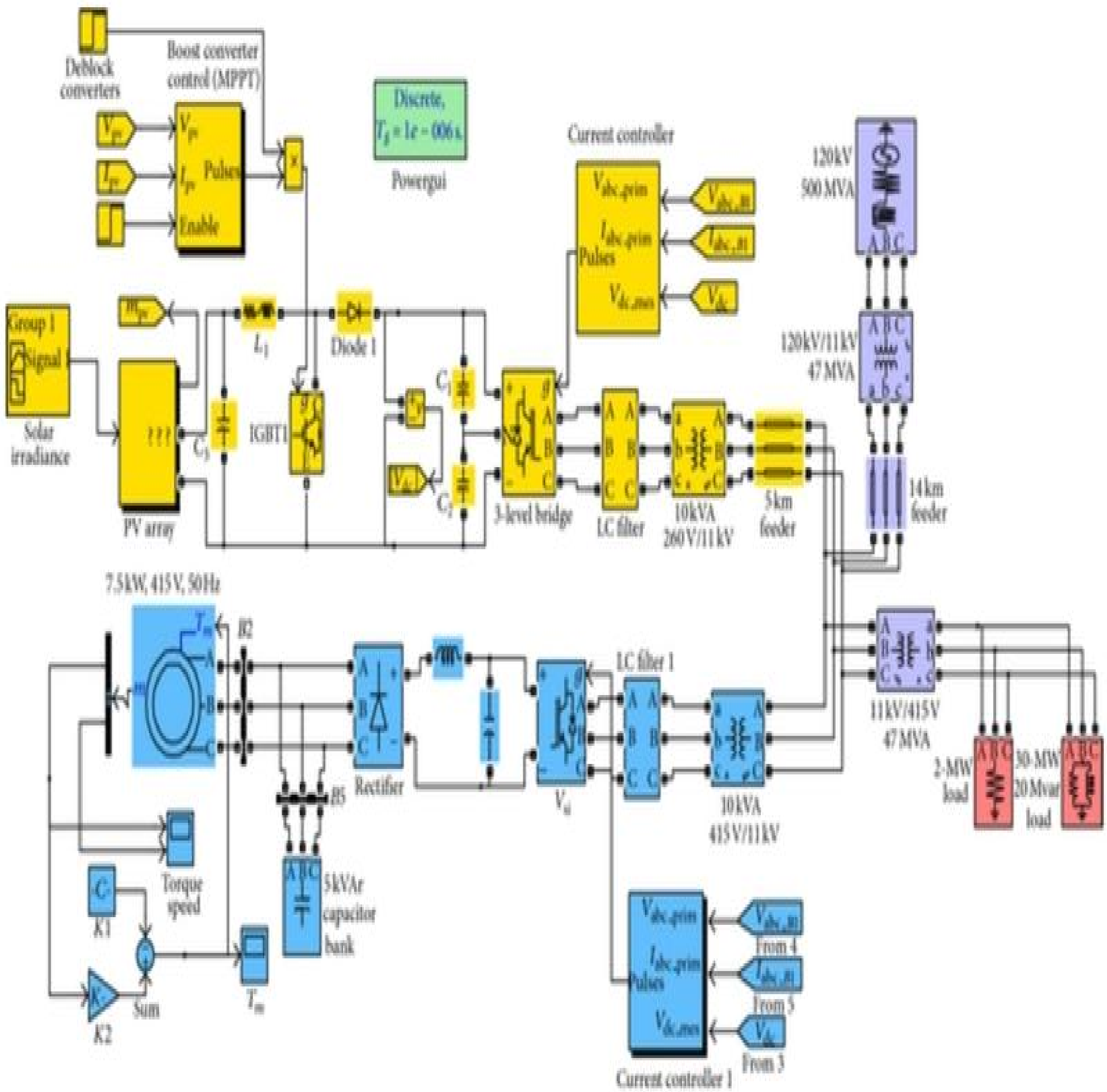


Deblock converters
Boost converter control (MPPT)
Discrete, T_s = 1e − 006 s.
Powergui
Current controller
120 kV 500 MVA
120 kV/11 kV 47 MVA
Group 1 Signal
Solar irradiance
PV array
L_1
Diode 1
IGBT1
3-level bridge
LC filter
10 kVA 260 V/11 kV
5 km feeder
14 km feeder
7.5 kW, 415 V, 50 Hz
B2
B5
Rectifier
LC filter 1
11 kV/415 V 47 MVA
2-MW load
30-MW 20 Mvar load
10 kVA 415 V/11 kV
5 kVAr capacitor bank
Torque speed
K1
K2
Sum
T_m
From 4
From 5
From 3
Current controller 1

RESULT:

Thus study of simulation of PV systems using MATLAB Simulink model Completed.

Ex.No:2

Experiment on VI-Characteristics and Efficiency of 1kWp Solar PV System

Date:

AIM:

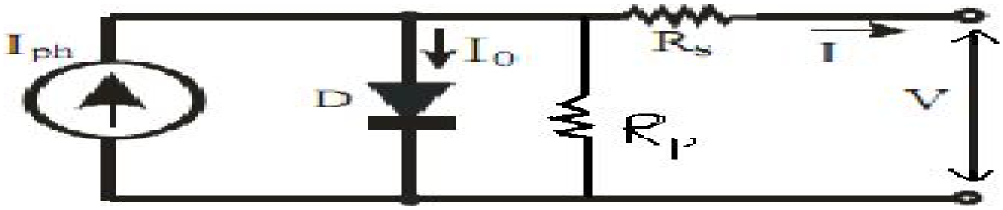
To tabulate voltage and current parameters of 1kw PV panel to study VI characteristics and efficiency.

APPARATUSREQUIRED:

S.No	Name of the Apparatus	Range	Quantity
1.	1KW PV panel		1
2.	Voltmeter	(0-300)V	1
3.	Ammeter	(0-10)A	1
4.	1KW Variable Resistor		1
5.	Connecting wires		As required

THEORY:

A material or device that is capable of converting the energy contained in photons of light into an electrical voltage and current is said to be photo voltaic(PV). A simple equivalent circuit model for a PV cell consists of a real diode in parallel with an ideal current source. The ideal current source delivers current in proportion to the solar flux to which it is exposed. A more accurate model of a PV cell considers the effect of series and parallel resistance as shown. In a practical PV cell, there is a series resistance in a current path through the semiconductor material, the metal grid, contacts and current collecting bus. These resistive losses are lumped together as a series resistor (Rs). Similarly a certain loss is associated with a small leakage of current through a resistive path in parallel with the intrinsic device. This can be represented by a parallel resistor (Rp). Its effect is much less conspicuous in a PV module.



Equivalent circuit of a photovoltaic cell

CIRCUITDIAGRAM:

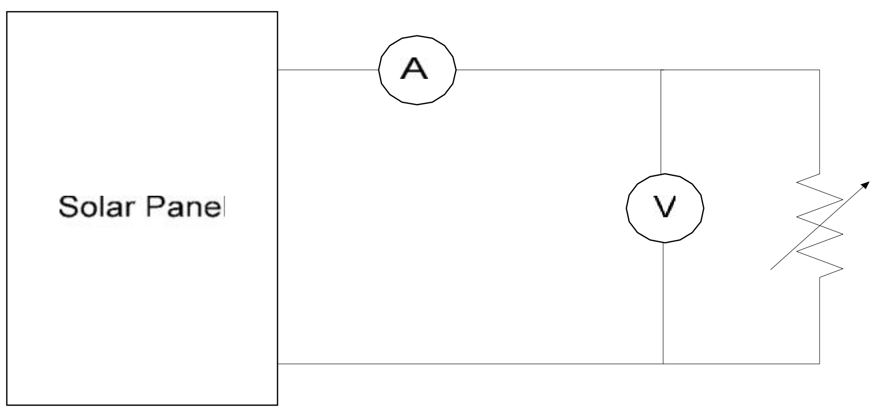
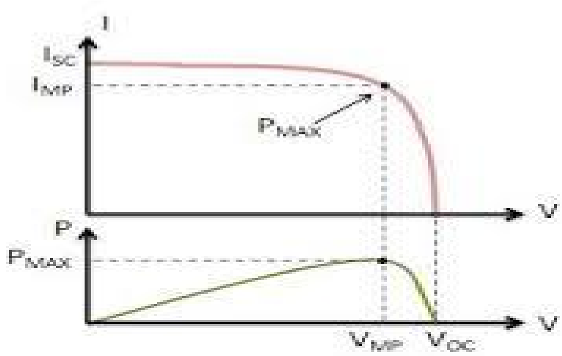


TABLE:

S.no	Voltage	Current	Power	Efficiency

PROCEDURE:

1. Choose the ammeter, voltmeter and rheostat ratings so that you get 20 uniformly spaced points on the V-I characteristics. Note that you cannot connect a single rheostat for this purpose.
2. You will need a low resistance to obtain points near the short-circuit condition, a high resistance to obtain points near the open circuit condition, and an intermediate value to obtain the maximum power point. This generally requires two or three rheostats of different ratings, with shorting switch connected across the high-resistance rheostat.
3. Vary the resistance in steps and obtain the V-I characteristics. Do NOT write down the readings to be plotted later. Plot directly while you are taking the readings. Otherwise you will not be able to get equally spaced points on the curve.
4. Obtain the open circuit and short circuit points by actually opening and shorting the terminals (not by bringing the rheostat jockeys to zero position). Be very careful about getting the correct slopes at the short circuit and the open circuitpoints.



I-V characteristics of pv panel

RESULT:

Thus VI parameters of 1kw pv panel analyzed, plotted and efficiency Calculated.

Ex.No:3

Experiment on Shadowing effect &diode based solution in 1kWp Solar PV System.

Date:

AIM:

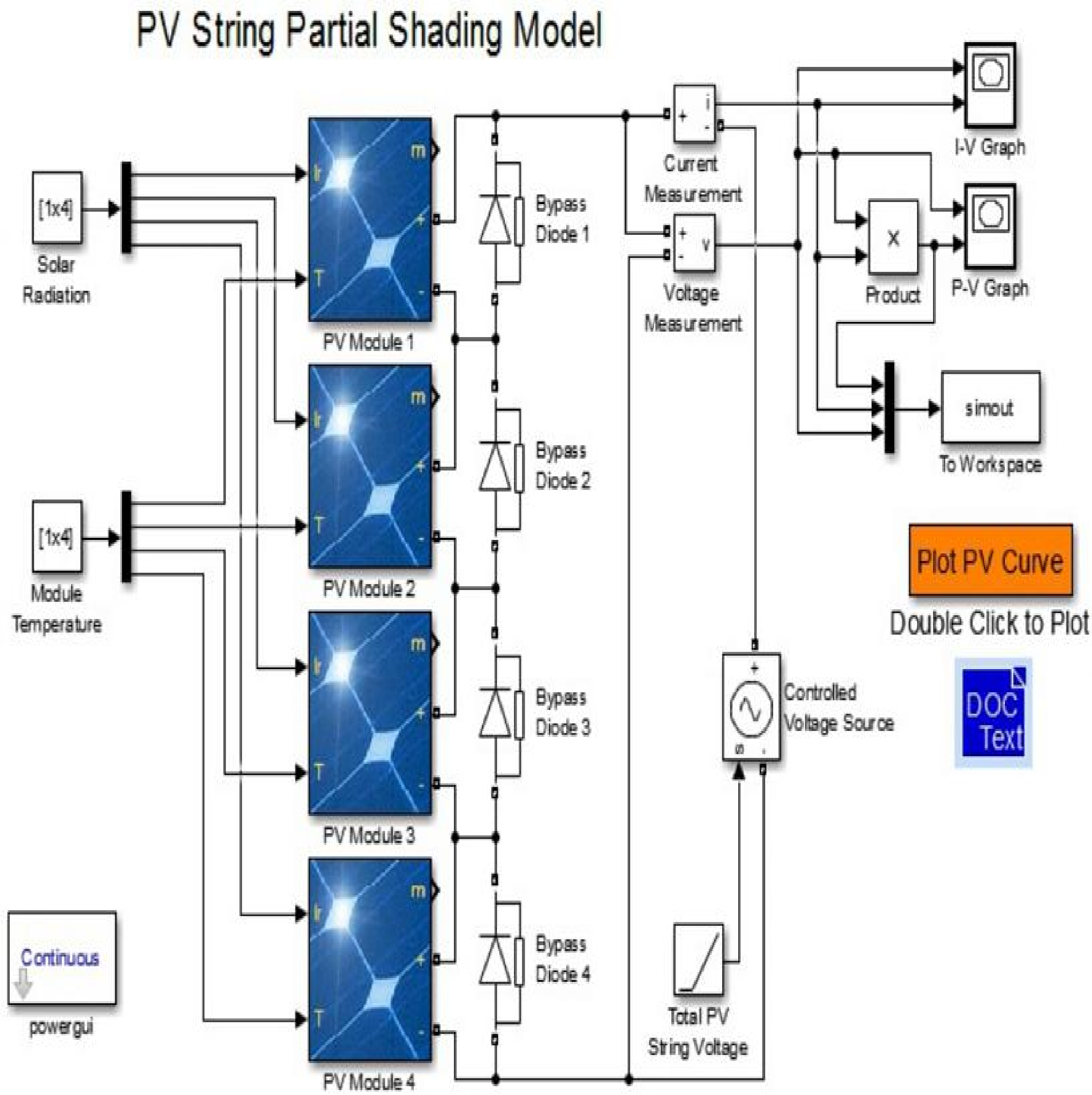
To design diode based solution for shadowing effect in solar PV system.

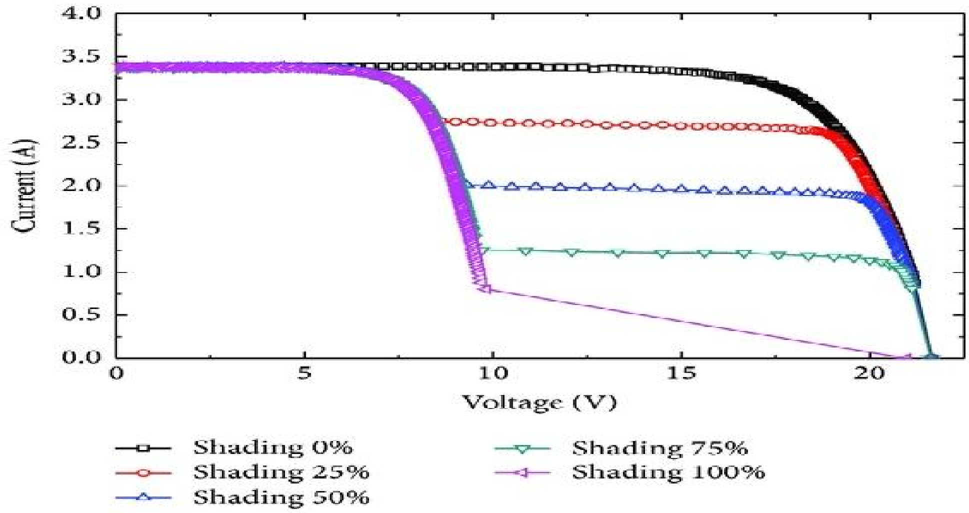
APPARATUS REQUIRED:

S. No	Name of the Apparatus	Specification	Quantity
1.	Simulation Software(MATLAB Simulink)		

THEORY:

The global I-V and P-V characteristics are plotted at the end of simulation. Note that the P-V curve Exhibits three maxima. When this PV module is connected to a voltage-sourced converter, this May be challenging for the Maximum Power Point Tracking (MPPT) algorithm to converge on The highest peak. The Global Maximum Power Point indicated by a red circle. Uniform Illumination intensity in a panel is not almost satisfied because of buildings or Trees shades, atmosphere fluctuation, existence of clouds and daily sun angle changes. Shade impact depends on module type, fill factor and bypass diode placement severity of Shade and string configuration. Power loss occurs from shade, also current mismatch Within a PV string and voltage mismatch between parallel strings.


PV String Partial Shading Model
[1x4]
Solar Radiation
[1x4]
Module Temperature
PV Module 1
PV Module 2
PV Module 3
PV Module 4
Bypass Diode 1
Bypass Diode 2
Bypass Diode 3
Bypass Diode 4
Current Measurement
Voltage Measurement
Product
I-V Graph
P-V Graph
simout
To Workspace
Plot PV Curve
Double Click to Plot
DOC Text
Controlled Voltage Source
Total PV String Voltage
Continuous
powergui



PROCEDURE:

1. Matlab Simulink model file is created.
2. Simulink library used to generate required components.
3. Scope is used to view results for different conditions of shadowing.

RESULT:

Thus shadowing effect analyzed with diode based solution for different condition.

Ex. No.4

Experiment on Performance assessment of Experiment on Performance Assessment of Grid connected and Standalone 1kWp Solar Power System

Date:

AIM:

To Conduct the Experiment on Performance assessment of Grid connected and Standalone 1kWp Solar Power System.

APPARATUS REQUIRED:

S.No.	APPARATUS	RANGE	TYPE	QUANTITY
1	Mat lab Simulink			1
2	Solar Panel	1 KW		1
3	Inverter Circuit			1
4	Converter circuit			1
5	R-Load			1
6	Connecting wires			As required

Standard Test Conditions (STC)

1. Temperature of the cell – 25°C. The temperature of the solar cell itself, not the temperature of the surrounding.
2. Solar Irradiance – 1000 Watts per square meter. This number refers to the amount of light energy falling on a given area at a given time.
3. Mass of the air – 1.5. This number is somewhat misleading as it refers to the amount of light that has to pass through Earth's atmosphere before it can hit Earth's surface, and has to do mostly with the angle of the sun relative to a reference point on the earth. This number is minimized when the sun is directly above as the light has to travel a minimum distance straight down, and increases as the sun goes farther from the reference point and has to go at an angle to hit the same spot.

Formula Used:

1. The specific energy yield is expressed in kWh per KWp and it calculated as follows:

$$S_P = E_{sys\ /\ P\ array\ –STC}$$

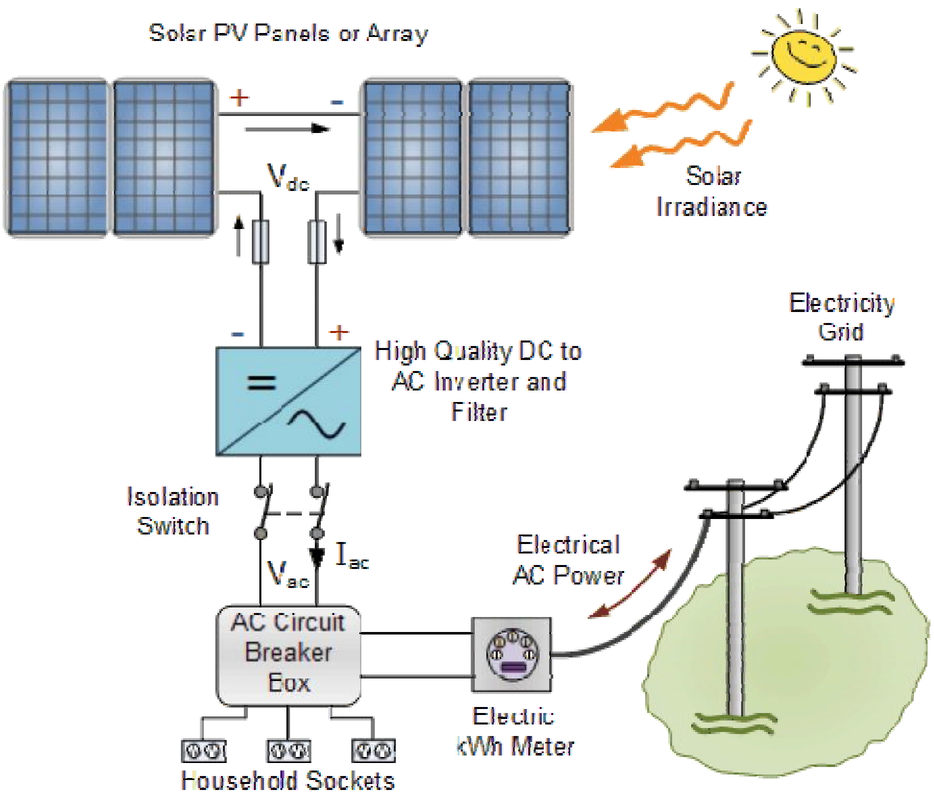
Where

The AC energy of the solar array delivered to the grid is the Esys in the above formula

While the actual STC rating of the array is P array STC.

2. The performance ratio (PR)

$$R = E\ sys / E\ ideal$$



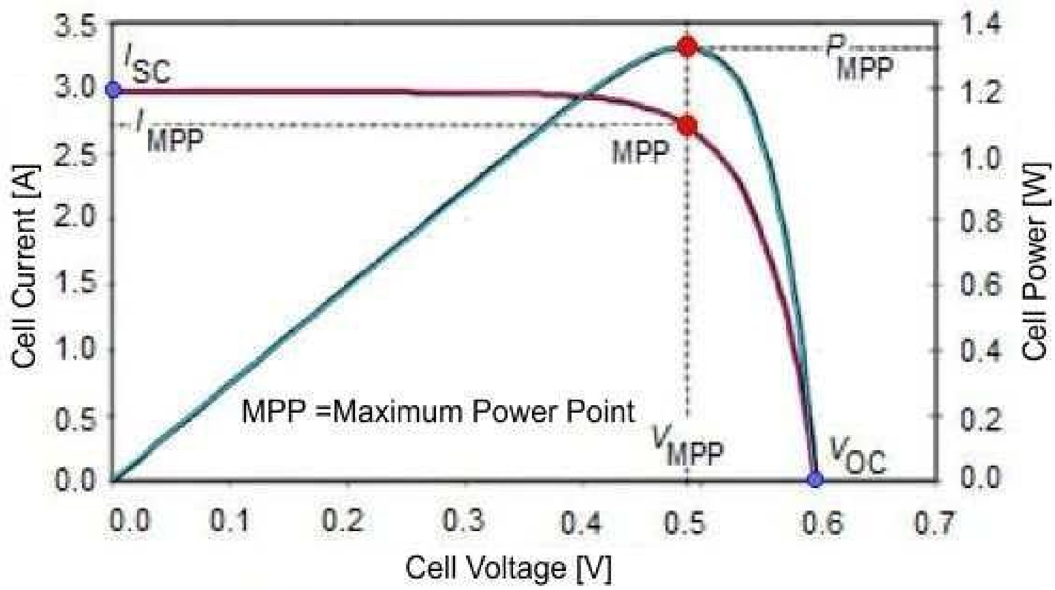
Block diagram of Grid Tied Photovoltaic Power System

Where

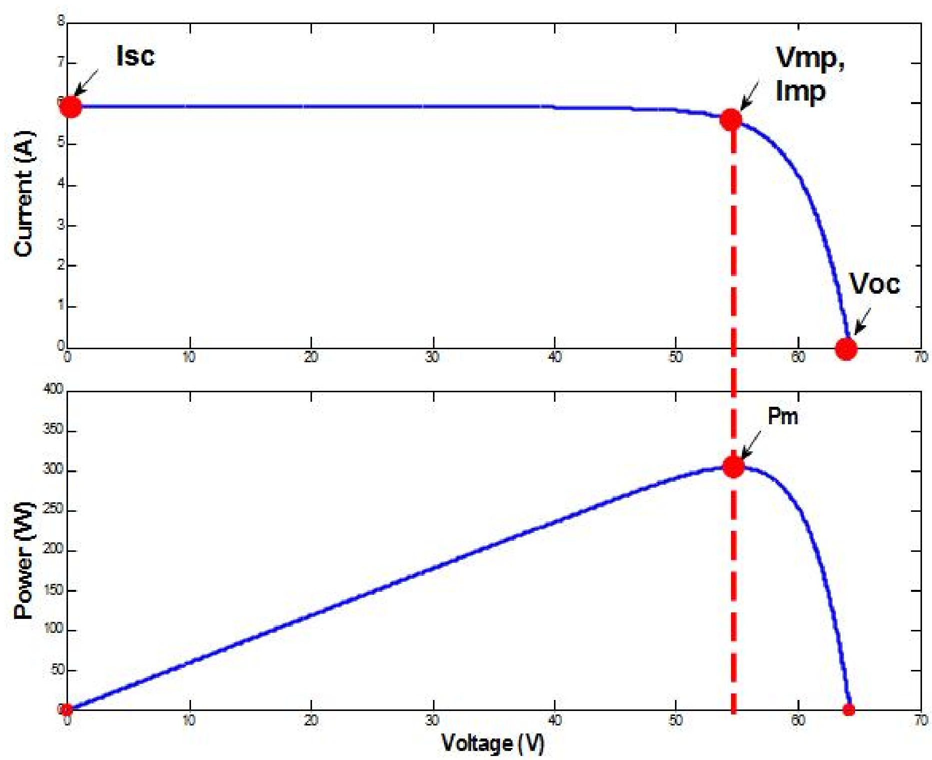
E sys - actual yearly energy yield from the system

E ideal- the ideal energy output of the array.

I-V Characteristics of PV System



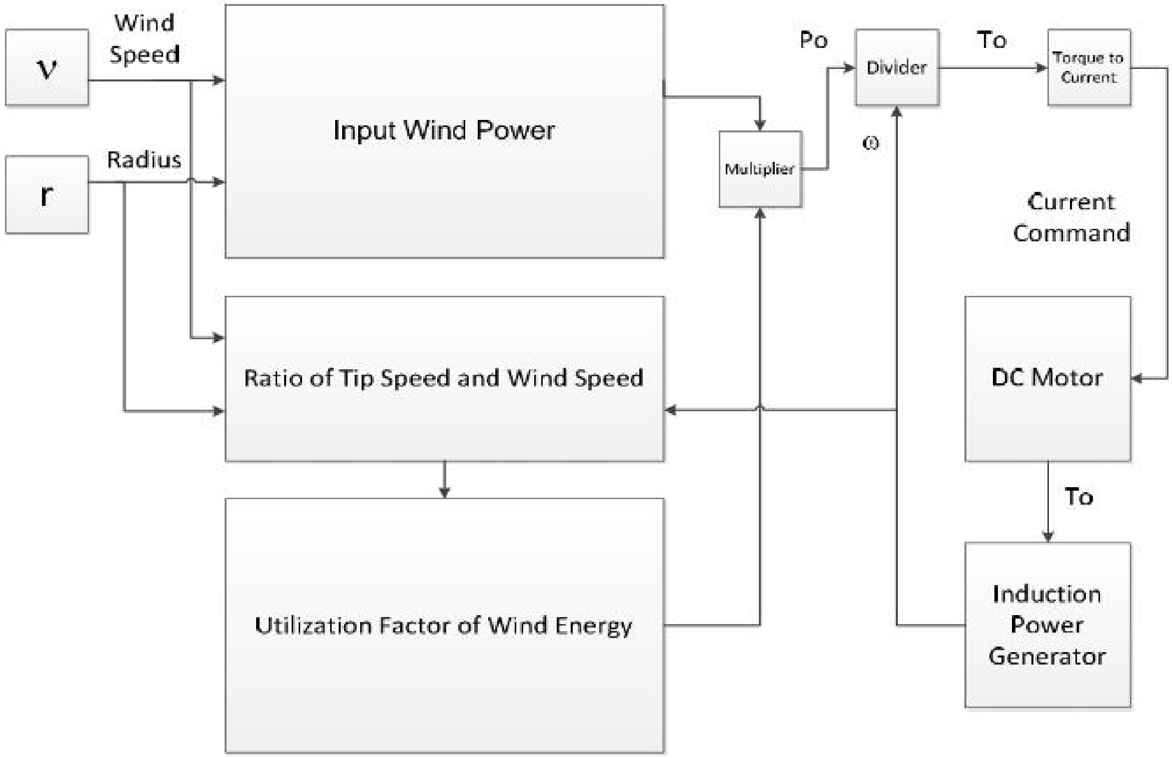
Power Vs Voltage and Current Characteristics.



RESULT:

Thus the Experiment on Performance assessment of Grid connected and Standalone 1kWp Solar power System was Performed using MATLAB Simulink.

CIRCUIT DIAGRAM:



Wind Turbine Simulation Block diagram

Ex. No.5

Simulation study on Wind Energy Generator

Date:

AIM:

To conduct the Simulation and study on Wind Energy Generator

APPARATUS REQUIRED:

S.No.	APPARATUS	RANGE	TYPE	QUANTITY
1	Matlab Simulink			1

THEORY:

Wind turbines work on a simple principle: instead of using electricity to make wind—like a fan wind turbines use wind to make electricity. Wind turns the propeller-like blades of a turbine around a rotor, which spins a generator, which creates electricity.

Wind is a form of solar energy caused by a combination of three concurrent events: The sun unevenly heating the atmosphere, Irregularities of the earth's surface and The rotation of the earthThe terms "wind energy" and "wind power" both describe the process by which the wind is used to generate mechanical power or electricity. This mechanical power can be used for specific tasks (such as grinding grain or pumping water) or a generator can convert this mechanical power into electricity.

A wind turbine turns wind energy into electricity using the aerodynamic force from the rotor blades, which work like an airplane wing or helicopter rotor blade. When wind flows across the blade, the air pressure on one side of the blade decreases. The difference in air pressure across the two sides of the blade creates both lift and drag. The force of the lift is stronger than the drag and this causes the rotor to spin. The rotor connects to the generator, either directly (if it's a direct drive turbine) or through a shaft and a series of gears (a gearbox) that speed up the rotation and allow for a physically smaller generator. This translation of aerodynamic force to rotation of a generator creates electricity.

FORMULA:

Power (W) = 0.6 x Cp x N x A x V3 .

Revolutions (rpm) = V x TSR x 60 / (6.28 x R),

Where

Cp = Rotor efficiency,

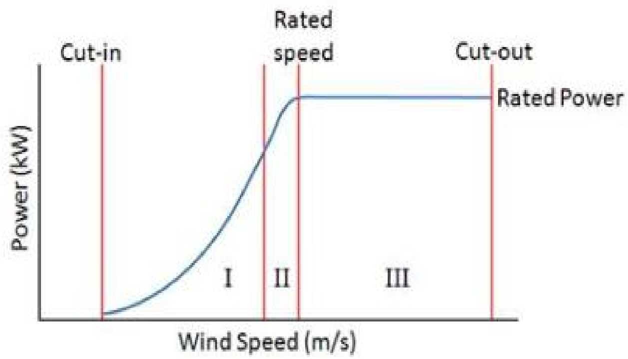
N = Efficiency of driven machinery,

A = Swept rotor area (m2),

V = Wind speed (m/s)

TSR = Tip Speed Ratio ,

R = Radius of rotor ,Rotor efficiency can go as high as Cp = 0.48, but Cp = 0.4

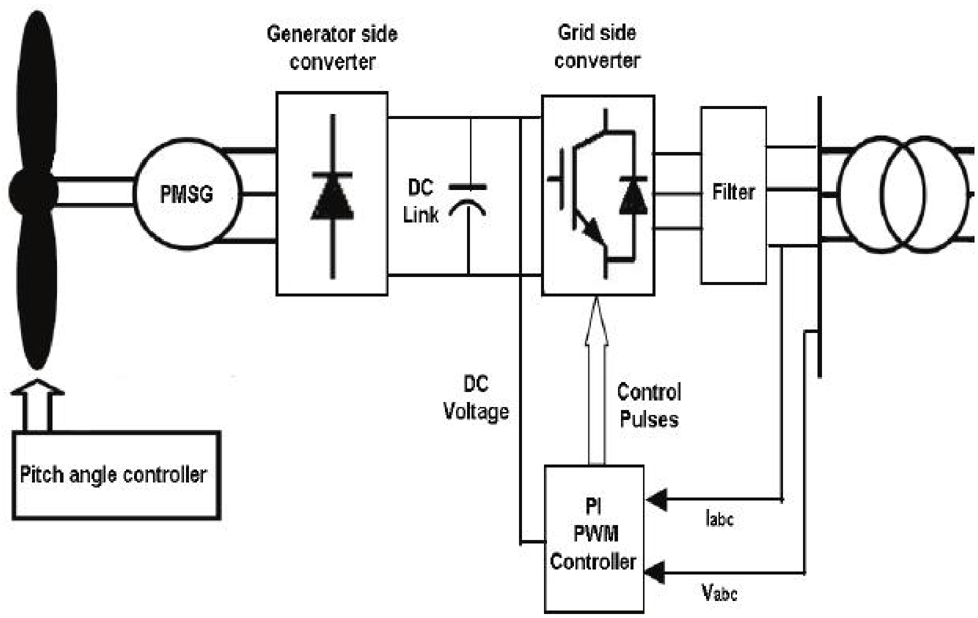


Speed vs Power characteristics.

RESULT:

Thus the simulation and study of wind turbine characteristics were obtained by using the MatLab Simulink.

Block Diagram for Small Wind Turbine



Ex. No.6

Experiment on Performance assessment of micro Wind Energy Generator

Date:

AIM :

To find the Performance assessment of micro Wind Energy Generator

APPARATUS REQUIRED:

S.No.	APPARATUS	RANGE	TYPE	QUANTITY
1				
2				
3				
4				
5				
6				

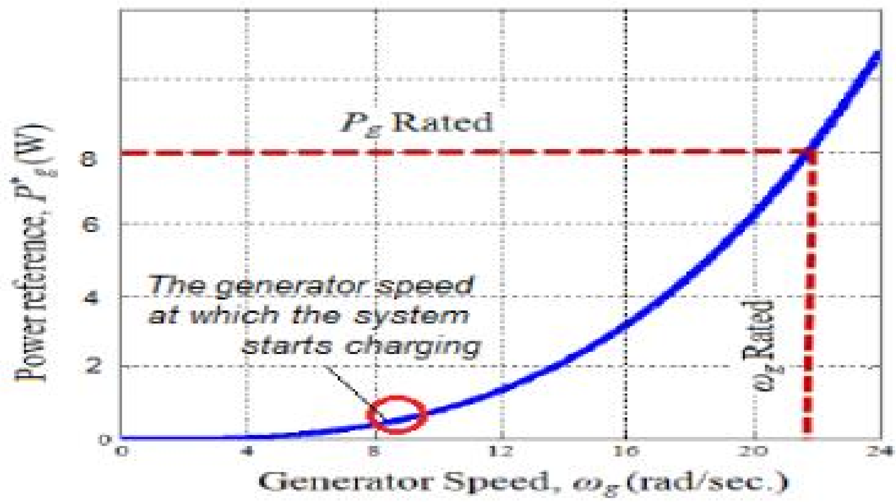
PROCEDURE:

1) Make the connections as per the circuit diagram.
2) To step up the output voltage of the generator and maintain Constant output voltage
3) DC to DC boost converter need be interfaced with the system.
4) In addition, the DC-DC converter compensates the fluctuations and maintain a smooth and a Continuous power flow in all operating modes.
5) The output of the DC to DC converter changed to AC output using DC/AC inverter

TABULAR COLUMN:

S.No	Wind Speed (m/s)	CP%	TSR λ	**Output Power (W)**

MODELGRAPH:



Wind Generator Vs Power

RESULT:

Thus the Performance assessment of micro Wind Energy Generator were obtained.

Ex no:7

Simulation study on Hybrid (Solar-Wind) Power System

Date:

AIM:

To study the simulation of Hybrid (Solar-Wind) Power System.

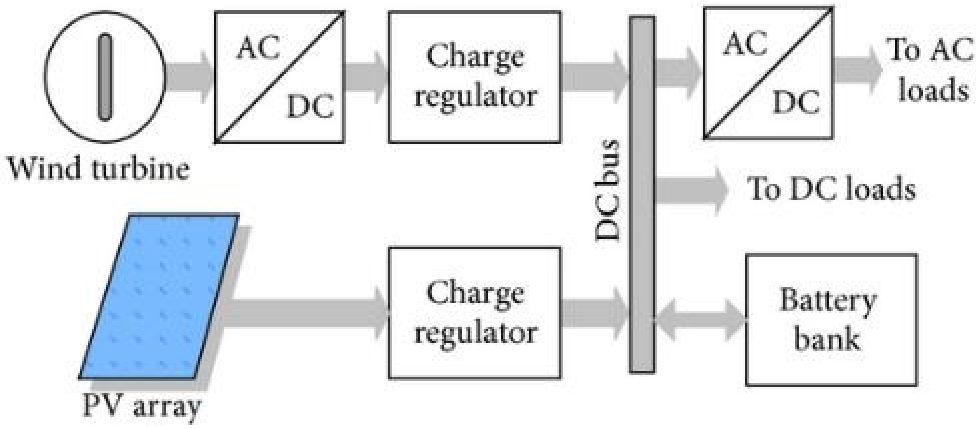
APPARATUS REQUIRED

S.No.	APPARATUS	RANGE	TYPE	QUANTITY
1	Mat lab Simulink			1
2	Solar Panel	1 KW		1
3	Inverter Circuit			1
4	Converter circuit			1
5	R-Load			1
6	Connecting wires			As required

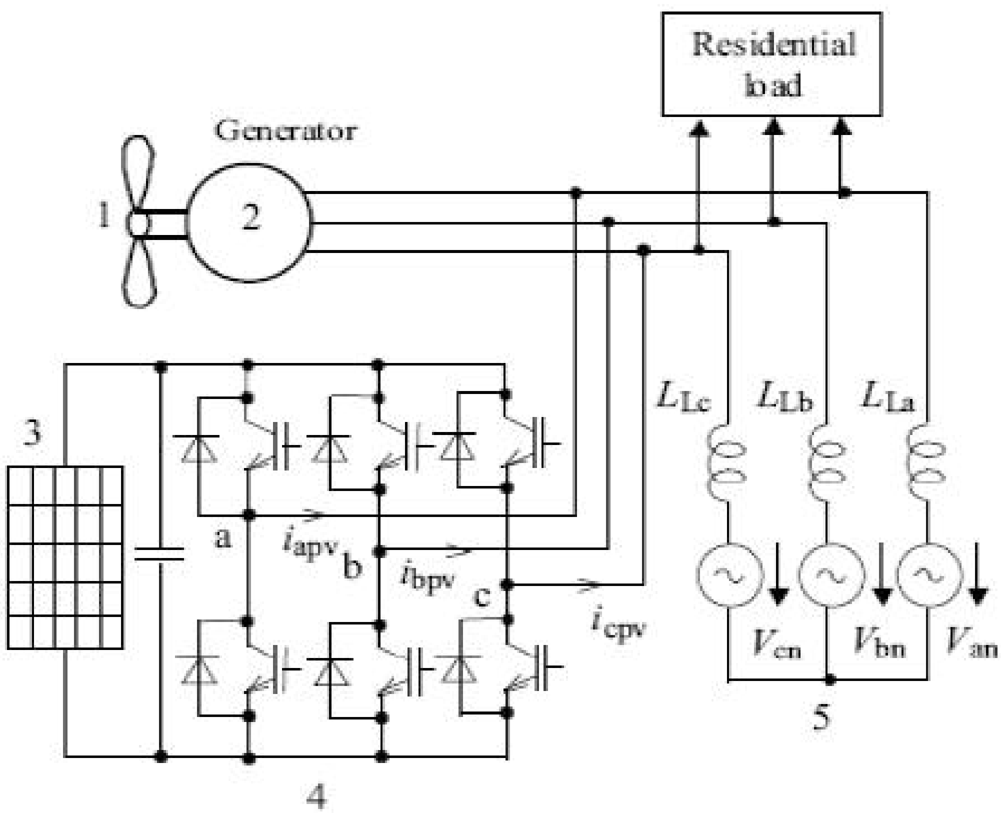
THEORY:

The Solar PV wind hybrid system suits to conditions where sunlight and wind has seasonal shifts . As the wind does not blow throughout the day and the sun does not shine for the entire day, using a single source will not be a suitable choice. A hybrid arrangement of combining the power harnessed from both the wind and the sun and stored in a battery can be a much more reliable and realistic power source. The load can still be powered using the stored energy in the batteries even when there is no sun or wind.

PV and wind system, both depending on weather condition, individual hybrid PV and hybrid wind system does not produce usable energy throughout the year. For better performance of the standalone individual PV combination or wind combination need battery backup unit and diesel generator set, which increase the hybrid system cost for proper operation and better reliability, and lower cost of the system, studies are reported by researchers regarding the combination of hybrid PV–wind system.



Combined solar and wind system model



Simulation diagram

PROCEDURE:

1. Matlab Simulink model file is created.
2. Simulink library used to generate required components.
3. Scope is used to view results for different conditions of shadowing.

Result

Thus the Hybrid (Solar-Wind) system simulated and the output were verified.

Ex No:8

Experiment on Performance Assessment of Hybrid (Solar-Wind) Power System

Date:

AIM

To conduct a experiment to analyse the performance of Hybrid (Solar-Wind) Power System.

APPARATUS REQUIRED

S.No	Name of the apparatus	Range	Type	Quantity
1	PV array			
2	Wind turbine			
3	Hybrid charge collector			
4	Battery bank			
5	Inverter			
6	Load			

THEORY

PV Array Performance Model

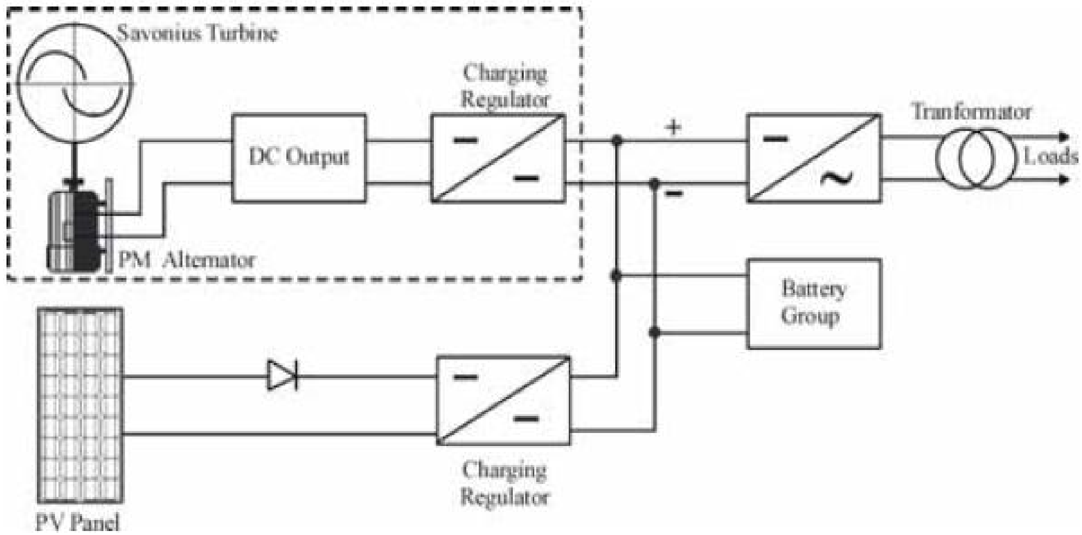
The PV module performance depends on weather conditions, especially solar radiation and PV module temperature. PV modules represent the fundamental power conversion unit of a PV system. It is mandatory to connect PV modules in series and in parallel in order to scale up the voltage and current to tailor the PV array output.

If a matrix of $Ns \times Np$ PV modules is considered, the maximum power output of the PV system can be calculated by

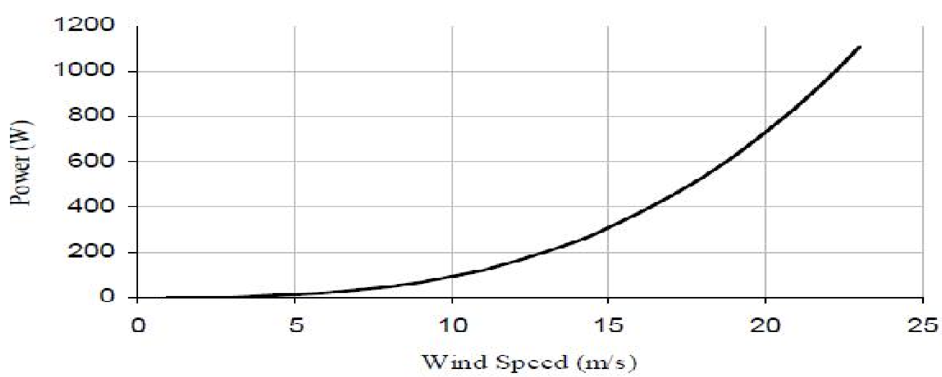
$$PPV = N p .N s .P \text{ module}. \eta \, MPPT . \eta \, oth$$

η MPPT is efficiency of the maximum power point tracking, (constant value of 95% is assumed)

η oth is the factor representing the other losses caused by cable resistance and accumulative dust.



Combined solar and wind system model



Power curve of the savonius wind turbine

Wind Turbine Performance Model

A wind turbine turns wind energy into electricity using the aerodynamic force from the rotor blades, which work like an airplane wing or helicopter rotor blade. When wind flows across the blade, the air pressure on one side of the blade decreases. The difference in air pressure across the two sides of the blade creates both lift and drag. The force of the lift is stronger than the drag and this causes the rotor to spin. Power from Wind Turbine Generator. The wind fan may rotate in clockwise or anti clockwise direction. So the power generated from wind generator may be positive or negative, in order to get the positive power polarity corrector is connected to the wind turbine. This converts the AC power into DC power. Wind power may not be constant so a regulator circuit is connected and this regulated power is given to charge the battery

If the average wind speed reaches 10 m/s and above, SWT can produce electricity at the rated power. In the case of wind speed lower than 10m/s, electricity production is less than the rated power.

PROCEDURE:

1. Matlab Simulink model file is created.
2. Simulink library used to generate required components.
3. Scope is used to view results for different conditions of shadowing.

Result:

Thus the Performance of Hybrid (Solar-Wind) Power System was observed.

Ex.No: 9

Simulation study on Hydel Power

Date:

AIM: To study hydel power system using MATLAB Simulink software.

APPARATUS REQUIRED:

S.No	Nameof the Apparatus	Range	Quantity
1.	Simulation software(MATLAB Simulink)		

THEORY:

The under damped rotor speed characteristic of hydro (synchronous) generator from the characteristics, it is observed that the transient time is 40s. After 17s its speed reaches steady state at synchronous speed. With sudden application of mechanical torque input to the shaft of alternator, the load angle settles to a steady state value after few oscillations owing to system damping following the swing equation and power angle characteristics. Moreover, the governor setting *kp*= 0.613 *ki*= 0.104 and *kd*= .0002 chosen by trial and error method helps to keep the speed near synchronous speed (1.02pu).shows the stator current characteristics of the generator. When the load is changed, due to the presence of the transient and sub-transient reactance, envelop of three phase current shows under damped response at initial stage. After that it gains the steady state characteristics. It is observed from the plot that the transient period is 15s for three phase stator current.Active power characteristics of synchronous generator, which shows a steady state value of 0.6 pu i.e. 1800 W is nothing but the actual load connected to the plant. It is observed that the steady state is obtained around 27 sec. To reach the stable operating point on power - angle characteristics, few oscillations around this point occurs. This leads to initial overshoots and undershoots of the power characteristics.

PROCEDURE:

1. MATLAB Simulink model file is created.
2. Using Simulink library hydel power system model generated.
3. Scope is verified for different values.

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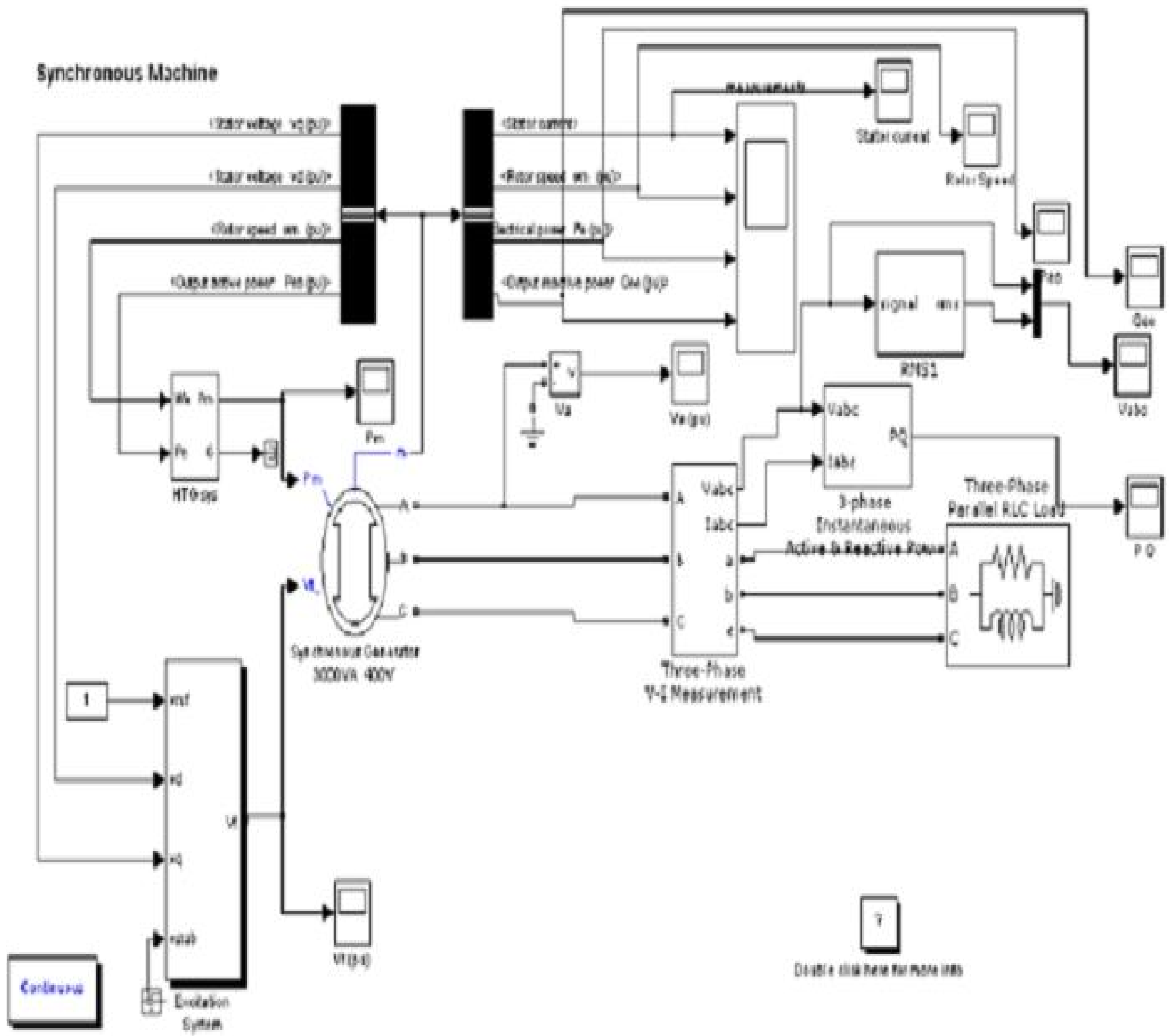
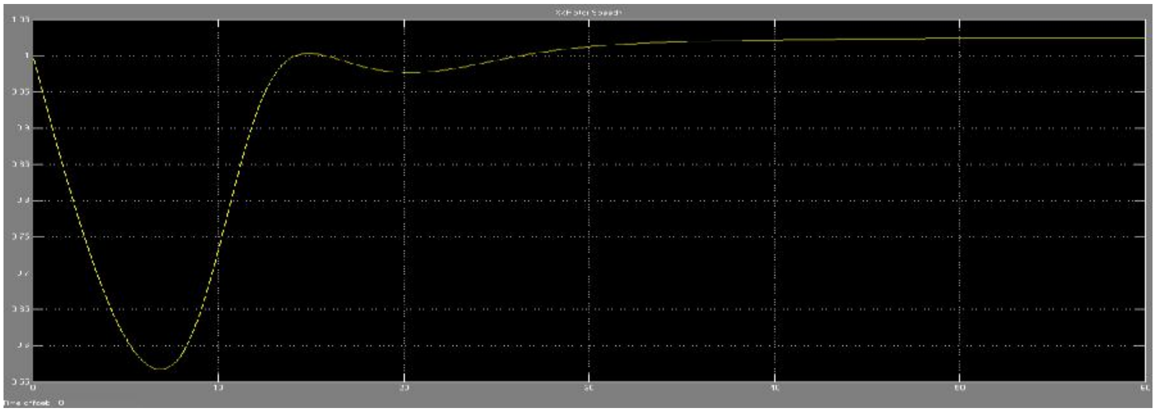
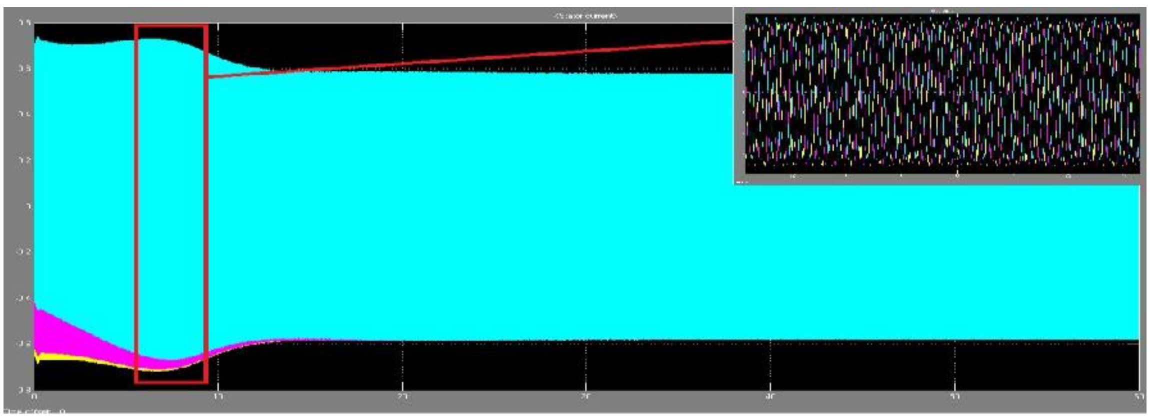


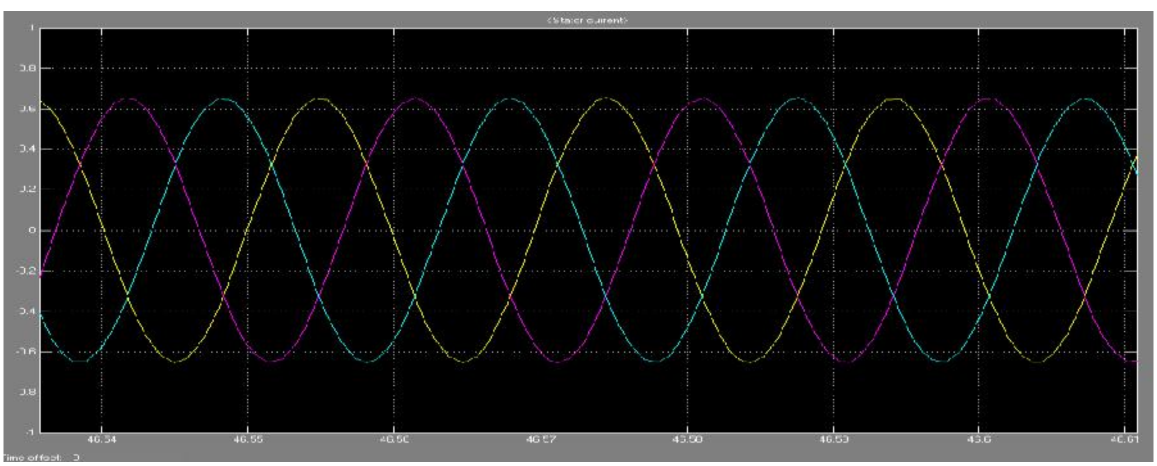
Synchronous Machine
Stator current
Rotor Speed
Pm
Va (pu)
RMS1
Vabc
Qeo
P Q
Three-Phase
Parallel RLC Load
3-phase
Instantaneous
Active & Reactive Power
Three-Phase
V-I Measurement
Synchronous Generator
3000VA 400V
Excitation
System
Continuous
Double click here for more info



Synchronous Generator Speed Characteristics (in *y*-Axis Speed in pu and in Sec)



Stator Three Phase Current Characteristics of a Hydro Power Plant (in *y* and in *x*-Axis Time in Sec)



Stator Three Phase Current Characteristics for 0.2sec at Steady State (in *y*-Axis Current in pu and in *x*-Axis Time in Sec)

RESULT:

Thus study of simulation of hydel power systems using MATLAB Simulink model Completed.

EXP.NO:10

EXPERIMENT ON PERFORMANCE ASSESMENT OF 100W FUEL CELL

DATE:

AIM:

To determine the voltage-current characteristics of the **100W** Fuel Cell.

APPARATUS REQUIRED:

S.No	Name of the Components / Equipment	Type/Range	Quantity required
1	Fuell cell trainer kit	FC100	
2	Connecting wires		
3	Computer with suitable software		
4	RS232 Interface		

PROCEDURE:

Set up

- Connect the AC power pack cable to the **12V**DC power input on the FC50 Fuel Cell. Connect the other end of the AC power pack to a source of AC power. On the front panel of the EL200 Electronic Load ensure the toggle switch is **OFF**. Use the AC power cord to connect the EL200 to a source of AC power; then turn on the main power switch located behind the EL200 front panel.
- Use two short test leads to connect the FC50 with the EL200, paying attention to the polarity.
- Attach the hydrogen supply quick-coupler to the FC50. Connect the 9-pin plug of the hydrogen
- supply's solenoid valve to the **H2 SUPPLY** connector on the FC50.
- Connect the required RS-232 interface to the computer.

Start up

Starting the electrolyser

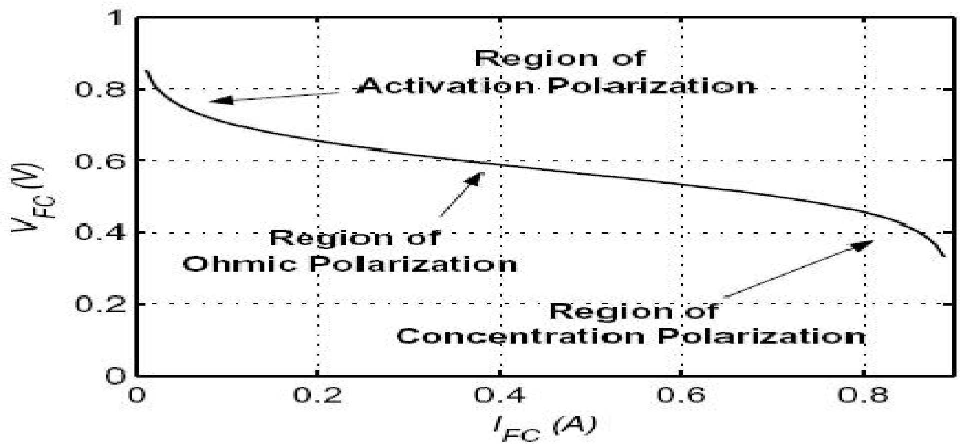
- Connect the AC power Cable to the supply and switch it ON.
- There will be a self check of 20 seconds by the electrolyser system. After that the main screen of the Graphic display will show STANDBY.
- Press the Start button and wait until the internal pressure reaches 100%. Now the display shows ready.
- Press Open**.** The external pressure will reach to the set pressure and the display will show Normal flow and Normal pressure.
- For the EL200 ensure that the 10-turn potentiometer is set to zero. Then turn ON the toggle switch on the front panel**.**
- Ensure the fan control knob is at **AUTO**. Set the main switch to **ON** and press the **START** button in the FC 50 module. After completing a system test, the green **OPERATION** light comes on and the
- FC50 is ready for use. If an error occurs, the error code will appear in the**H2 Flow** display.

Data acquisition

- For these measurements, the fuel cell should be at a temperature of 35 °C.This temperature can
- be reached by loading the fuel cell for a few minutes with a current of approximately 5 A. Using thepotentiometer of the EL200, increase the load current until the Current display on the FC50 showsapproximately 5 amperes. To further cause stack temperature to rise, turn the fan control knob on the FC50 so the Fan Power display indicates 10%.After the temperature reaches 35 °C, ensure the load potentiometer is turned back to zero and set fan control knob to AUTO.
- Using the EL200 potentiometer, set in turn each load current listed in theTable1. After waiting at
- least 15 seconds at each point, record the measured values of stack current Istack and stack voltage Vstack in the table. When measuring the first point (no-load operation) turn the toggle switch on the EL200 to OFF to ensure that there is no load on the fuel cell.

Shut down procedure

- On the EL200, turn the potentiometer to zero, set the toggle switch to **OFF,** and turnoff the
- main power switch behind the front panel.
- On the FC50, turn the fan control knob to **AUTO** and turn the main switch **OFF**.
- Shut down of the Electrolyser :
  1. Press the close button to cut the hydrogen supply. The display then shows ready mode.
  2. Now press the Stop button so that the electrolyser comes in Standby mode.
  3. Switch off the power supply.



Report Tabulation:

Nominal current (A)	I_{stack}(A)	V_{stack}(V)	P_{stack}(W)	Hydrogen Flow Rate (ml/min)	Temperature(^{o}C)

Graph

i. Draw the voltage-current characteristic *V*stack = f (Istack) of the fuel cell.
ii. Explain the resulting characteristic curve.

RESULT:

Thus voltage and current parameters for 100 fuel cell done and verified.

EXP.NO:11

SIMULATION STUDY ON INTELLIGIENT CONTROLLERS FOR HYBRID SYSTEMS

DATE:

AIM:

To study the simulation of intelligent controllers for a Stand-Alone Hybrid Generation System.

THEORY:

The study aims at the modeling and power flow analysis of a stand-alone hybrid generating system (SAHGS) comprising of wind and photovoltaic systems. The wind driven self-excited induction generator (SEIG), photovoltaic array and other network components are modeled and simulated using Matlab/Simulink. The variable voltage and frequency of a generator is first rectified and controlled by a DC/DC converter before being fed to a common DC bus.

The variable output voltage of the photovoltaic module is also controlled by a DC/DC converter. The DC bus collects the total power from the wind and photovoltaic systems and uses it partly to supply the required load demand and partly to charge the battery bank. The individual systems are simulated for varying wind velocities and solar intensities respectively and the results are used to identify the operating modes. A neuro controller is designed to adjust the duty ratios of the choppers and the firing angle of the converter at which the maximum power generation occurs.

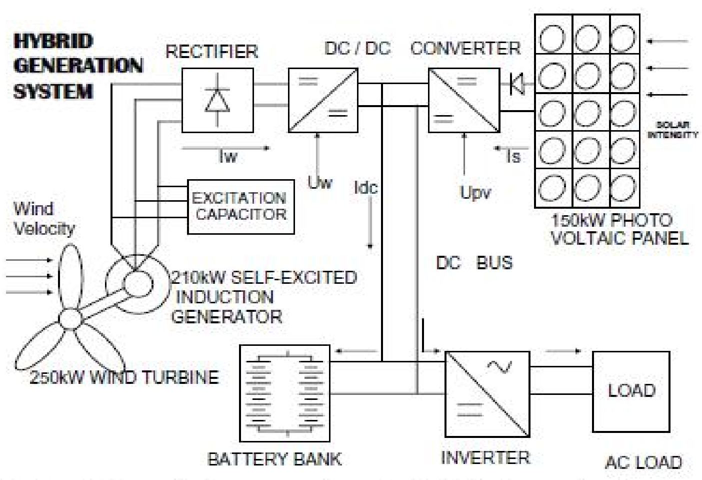


Fig. 1. Schematic Representation of a Hybrid Generation System.

The SAHGS considered for study is a combination of the wind and photovoltaic systems as shown in Fig. 1. The wind system houses a 250kW wind turbine that converts the kinetic energy present in the wind into mechanical energy, which drives the 210kW self–excited induction generator through a gear box. Since the wind is an intermittent source of energy, the output voltage and frequency from the generator will vary for different wind velocities.

The variable output ac power from the generator is first converted into dc using an uncontrolled diode bridge rectifier.A buck chopper is used to match the variable DC voltage with the DC bus. The voltage across the rectifier terminal is controlled by varying the duty ratio of the DC/DC converter before it is fed to the DC bus.

The photovoltaic panel is built up of a combination of series and parallel individual photovoltaic modules. As the solar intensity varies, the DC output voltage of the panel also varies. This variable DC output voltage of the panel is controlled by another DC/DC converter before it is fed to the DC bus. The common DC bus collects the total energy from the wind and the photovoltaic systems and uses it partly to supply the required load demand and partly to charge the battery bank. Under normal operating conditions of wind velocity and solar intensity, the battery bank is an additional load to the system. It acts as an additional source to supply the demand during low wind velocities or solar intensities.

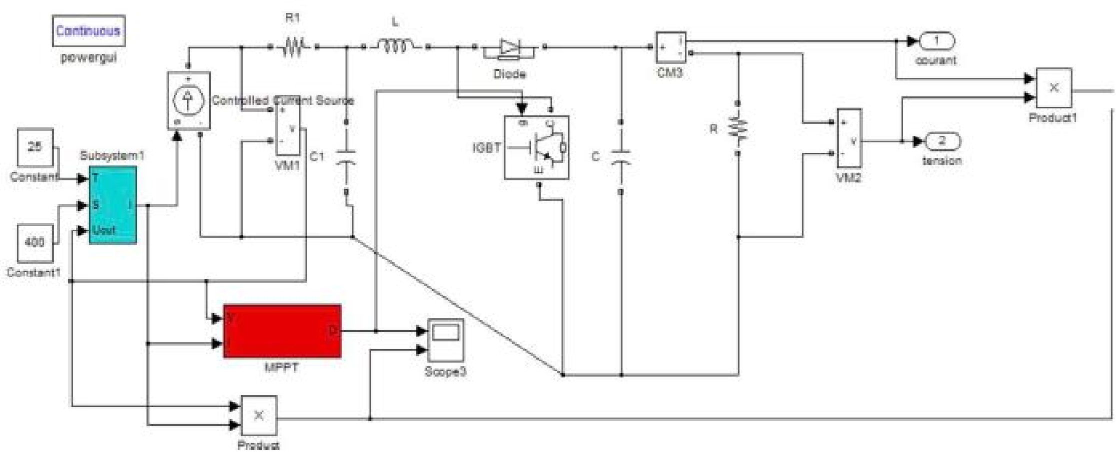


Fig.2.Model of the PV system developed under Matlab-Simulink

Response of the Neuro Controller

The neuro controller uses the wind velocity and the solar intensity as the input signals. The output of the controller are the duty ratios of the chopper and the firing angle of the controlled rectifier .Fig. 3. Simulation results of the PV system for varying cell temperatures.
The network architecture illustrated in Fig. is included in the SAHGS model for simulation. It is trained with about 150 simulation data using back propagation algorithm. The response of the controller for individual and simultaneous changes in both the wind velocity and the solar intensity are shown in Fig.3. It is observed that for every wind velocity and cell temperature,
the neuro controller automatically outputs the corresponding duty ratios of the choppers and the firing angle of the controlled rectifier respectively so as to extract maximum power and also to maintain the DC bus voltage constant.

The dynamic model of a hybrid generating system comprising a wind driven self-excited induction generator , photovoltaic system and the power conditioning circuit (uncontrolled rectifier –buck chopper) is developed. The individual system performance of the wind and PV systems are studied through simulation for varying wind velocities and solar intensities respectively .From the simulation results, the optimum value of excitation capacitance and number of battery are identified. It is found that the power generation increases with decreasing duty ratio (in turn the input voltage to the chopper) and the maximum generationis found to be 92 kW at dw =0.1 and 150kW at dPV =0.13 respectively . A further reduction in dc voltage is obtained by using a controlled rectifier and improvement in power generation is found to be about 17 percent of rated value. The simulation is repeated for varying wind velocities and the optimum value of alpha and duty ratio are found. Similar analysis is carried out for the solar system also and the optimum duty ratio is found for different cell temperatures. The neuro controller designed for the automatic variation of dw, dPV and alpha exhibits an excellent dynamic response.

RESULT:

Thus the study of simulation of intelligent controllers for a Stand-Alone Hybrid Generation System has been done.