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Design Directional protection scheme against islanding for grid connected pv system

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Abstract: *Many methods have been developed to protect this situation. Islanding is the hazardous condition for line workers. If islanding is not quickly detected, it can present serious hazardous condition. This paper present on design of Directional relay protection scheme against islanding for grid connected pv system***.**

Keywords: *Induction of islanding, System modeling, Directional Relay design, MATLAB/SIMULINK etc***.**

Introduction: When the distributed generator connected to the grid and power deliver to the load then in case of blackout the DG is continue to deliver power to the load this condition is islanding. Islanding is the dangerous to line workers. If the islanding is not detected it can present serious condition. When the islanding is occurs the voltage and frequency cannot maintain its standard level. Load generation mismatch is also the cause of the islanding.

Unintentional islanding is a connected to grid supply line that has DG attached to it. In the case of a blackout, the DG will continue to deliver power it is sufficient.

Intentional islanding the generator disconnects from the grid line, and forces the distributed generator to power the local circuit. This is often used as a power backup system for buildings that normally sell their excess power to the grid. In the power system cascading tripping is also the reason for islanding in the system. Because of this reason some effects are occur in the power system. Due to some reason it is important to detect islanding quickly and accurately for islanding protected. So in this paper present on design of over current protection scheme against islanding grid connected Pv system.

System Details:

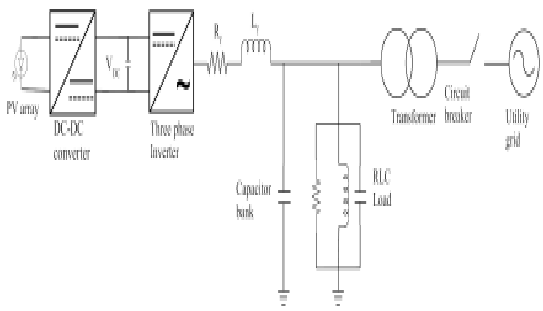
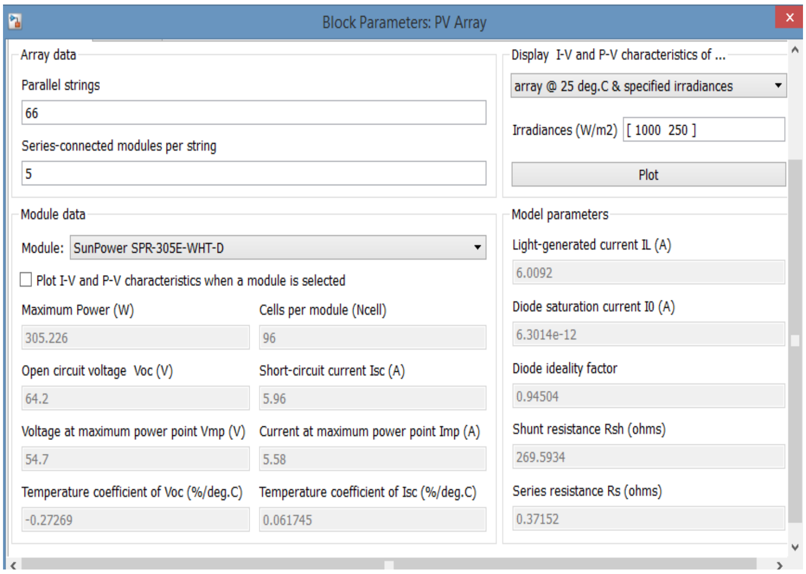


Table-1

SR NO.	EQUIPMENTS	RATING OF EQUIPMENT
1	GENERATOR	120KV,2500MVA
2	TRANSFORMER 1	100KVA,260V/25KV
3	TRANSFORMER 2	47MVA, 120KV/25KV
4	X'MISSION LINE 1	25KV,5KM
5	X'MISSION LINE 2	25KV,14KM
6	PV	275V

The shown in the above table is one generator, two transformer, pv and transmission line was used in the system.

System details of Pv array:

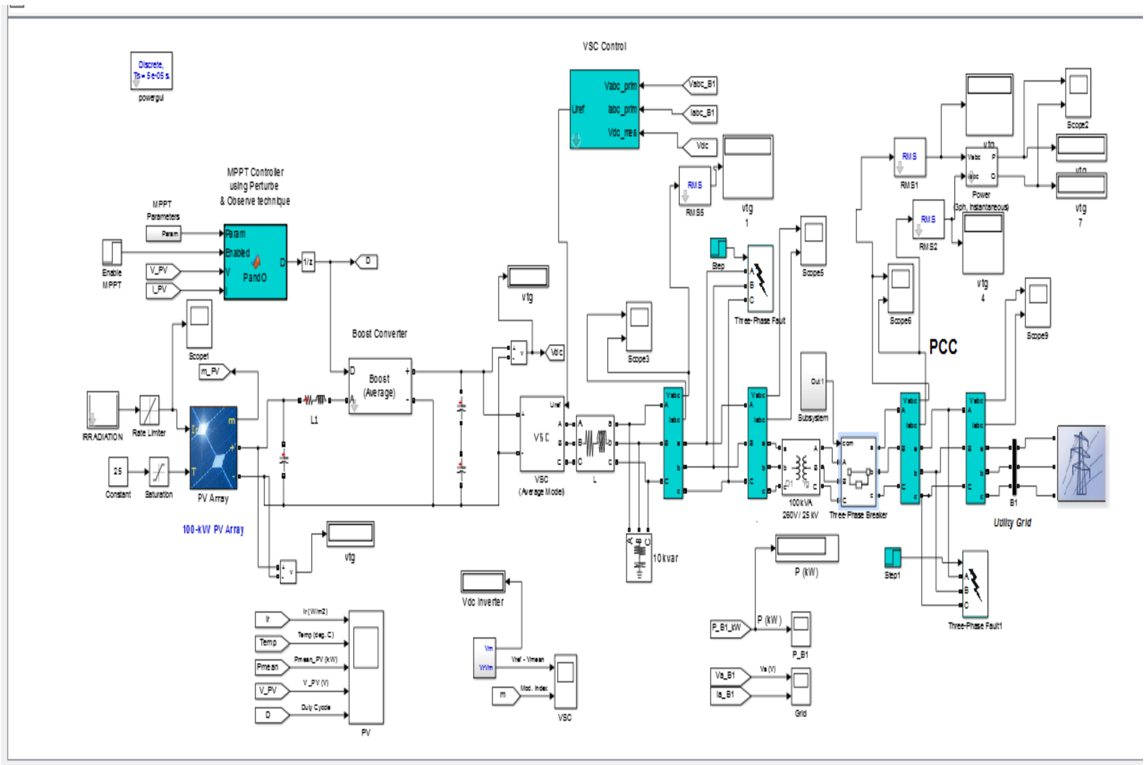


(Figure -1)

Above figure mention that what is my parallel and series module per string. It is also mention what is my maximum power and open circuit voltage. The temperature of my pv module is 25^0 Celsius.

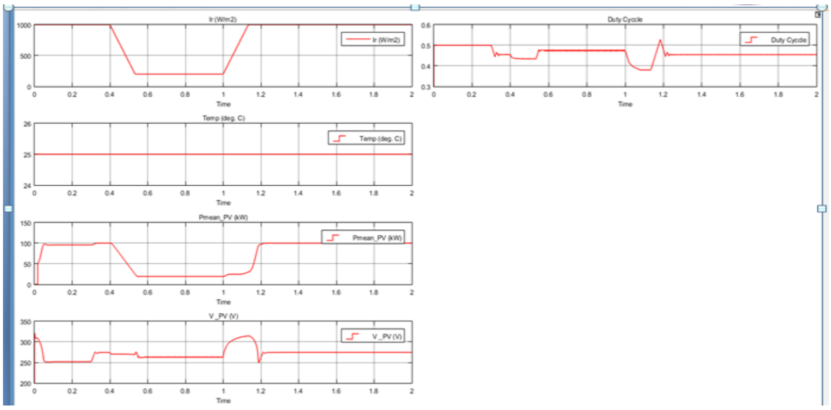
System Modeling:

The simulation of grid connected pv system has been designed by used of simulink library blocked in matlab. The pv source connected to converter then inverter and is connected to transformer and utility grid. The simulink model shown in below figure-3.



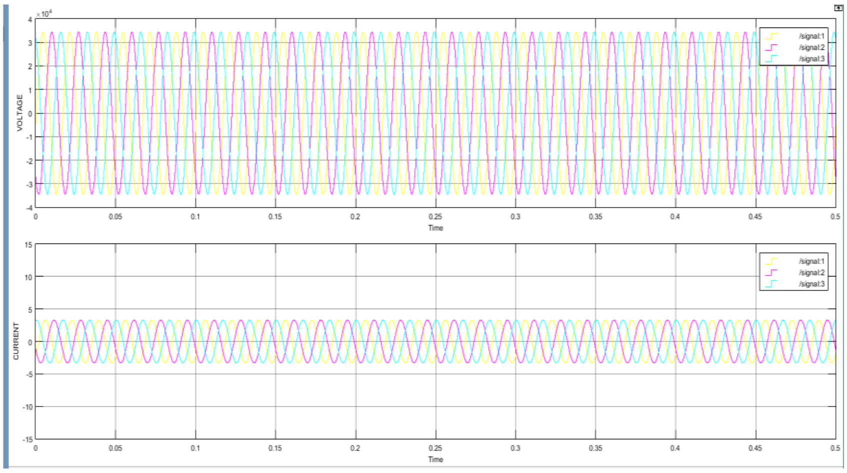
(Figure-3 MATLAB SIMULINK- MODEL)

The model has been done by used of matlab block and designs some system. The system is integrated at 25 kv voltage. Boost converter has controlled by the some PandO technique. The pv measurement shown in below figure-4.



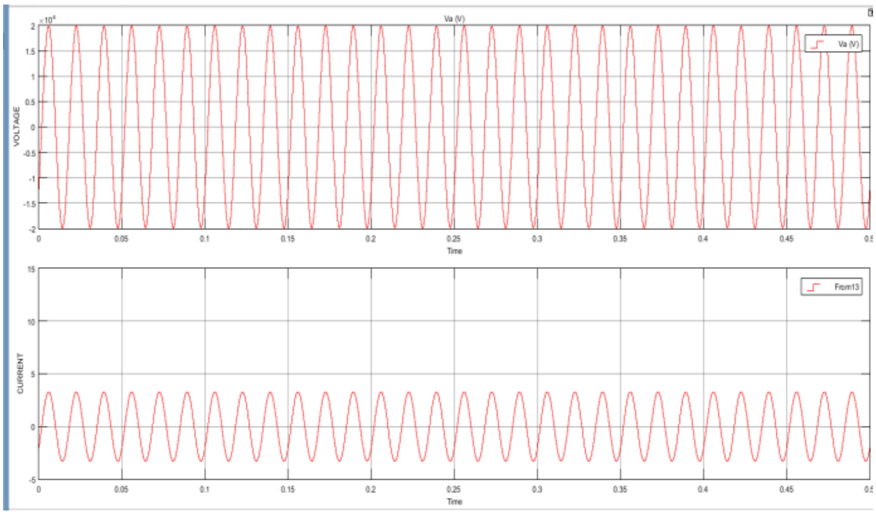
(Figure-4 pv measurement)

In the shown in above figure the irradiance change by some-time interval and the temperature is 25^0Celsius. The power of shown in above figure is changed by the irradiance.
The system is integrated at 25 kv voltage at PCC point. So the PCC voltage and current shown in the below figue-5.



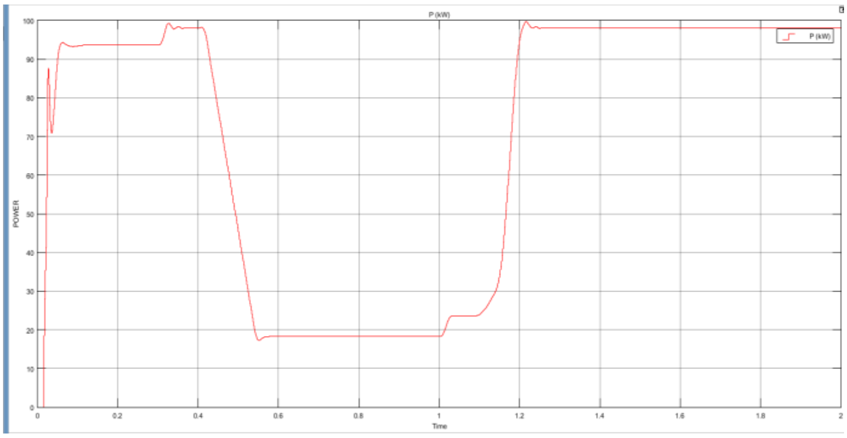
(Figure-5 PCC voltage & current)

The whole system has been generated the power is 100 kw. so the grid side what was the current and voltage is shown in below figure-6.



(Figure-6 gird voltage & current)

The system has been generated 100 kw power. So the system grid side power shown by the below figure-7.

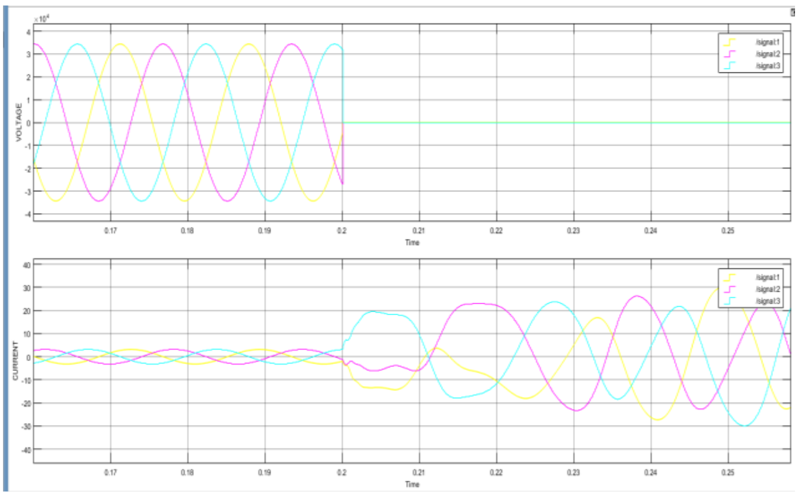


The system has been integrated at PCC point in the system. In healthy condition what was the voltage, current, grid power etc was shown in above figure. When the three phase fault was occurred at PCC point what was the PCC voltage, current etc. when the LLL-G,LL-G,L-G fault was in the system that time what was the parameter of system shown the following table-2 was the short circuit analysis of the system.

Table-2

EQUIPMENT	HEALTHY CONDITION	LLL-G FAULT	LL-G FAULT	L-G FAULT
PV	274.45 V	309.82 V	345 V	373 V
Boost converter	500 V	734.09 V	806 V	903 V
PCC VTG	24.33 KV	2.43 V	17.87 KV	19.30 KV
PCC CURRENT	2.34 KA	20.41 KA	23.1 KA	24 KA
GRIDE POWER	98 KW	-5.84 KW	-5050	-5022

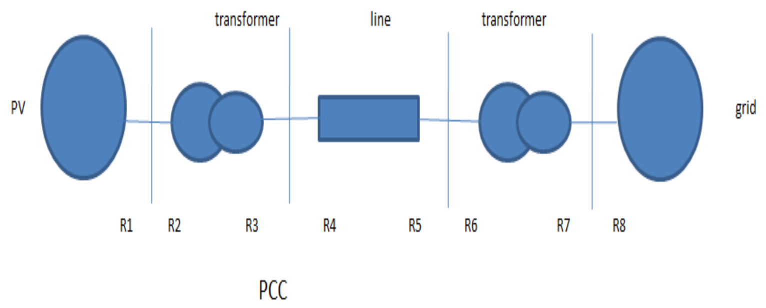
In the above shown in table-2 when the fault was in system what was the pv, inverter, PCC voltage and current.when healthy condition what was the value and when fault that time what was the value of system parameters.
So when fault was occurred in system what was the PCC voltage and current shown in below figure-8. Step time of the fault was 0.2 sec. after 0.2 sec fault was occurred in system. So voltage at PCC was zero and the current was increased.



(Figure-8 PCC voltage & current at LLL-G fault)

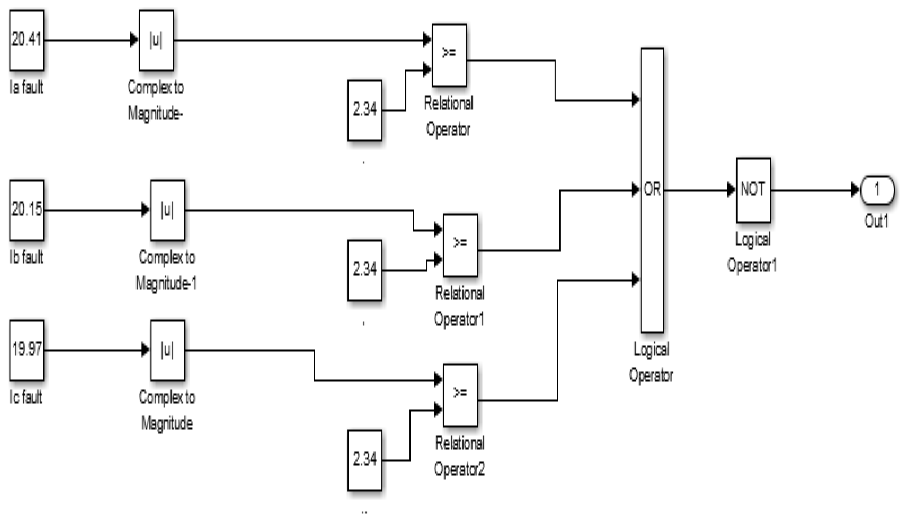
When in case of blacked out or fault occurred in the system that time the higher magnitude of current flowed in the system. Now in the system we could not decrease or remove the higher value of current the system parameter was affected and damaged. So we protect the system against the islanding and decreased the current value. So we has been used the over current protection for the islanding system.

Single line diagram:



The shown in the above figure is the single line diagram og the relay of system. There was eight relay R1 to R8 of the system. But in this paper the mail relay was at the PCC point relay. So when the islanding occurred at the PCC point. The PCC point relay was sensed the over current and tripped out the breaker of the system.

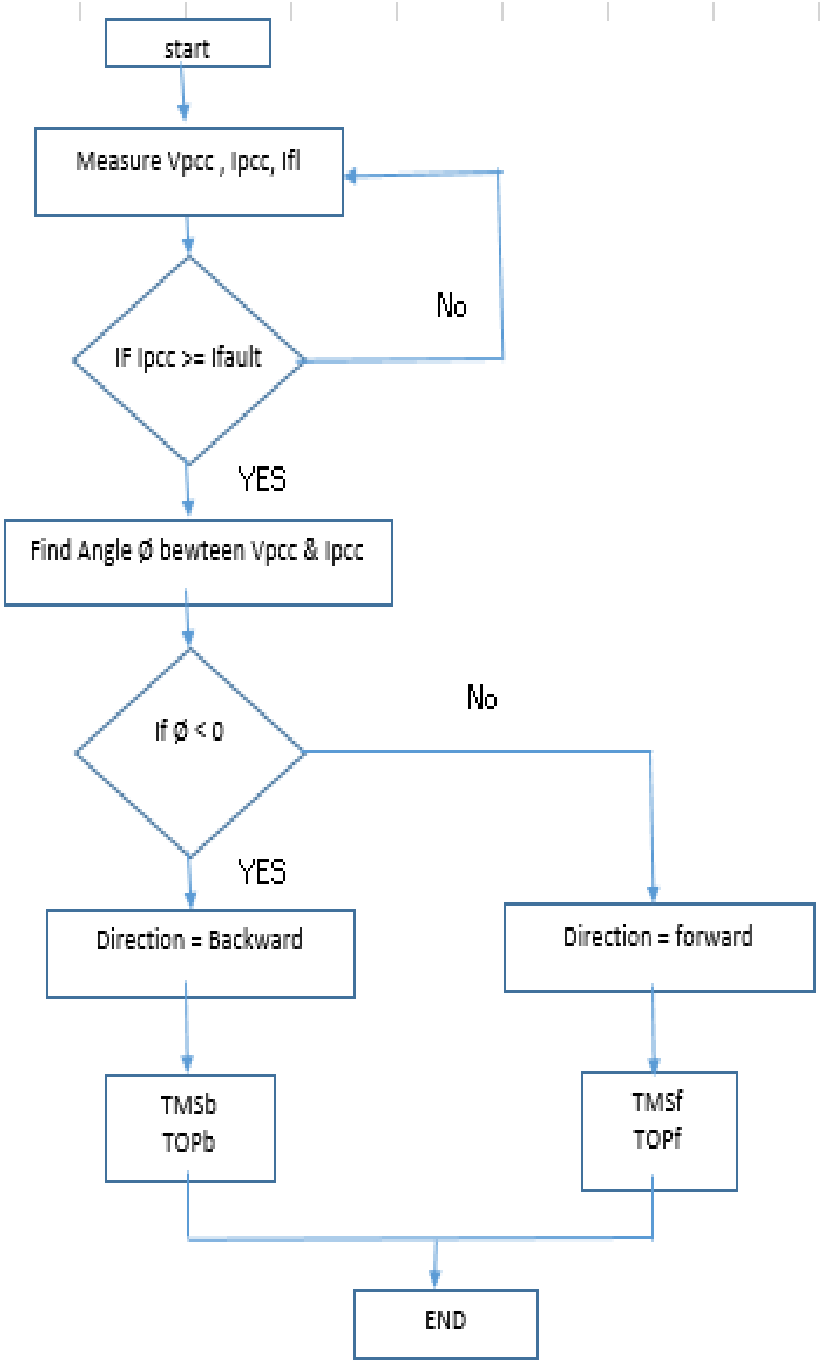
Over current relay based on the principle when the value of system current was increased by their threshold value the relay was sensed the higher value of current and circuit breaker was tripped out for the system.



(Figure-9 over current relay)

The shown in above figure is the logical over current relay. In this system when no fault was occurred that time PCC voltage was not increased their threshold value. In system when the fault has been occurred and the value is higher than the rated current the relay was sensed the fault and circuit breaker was tripped out. The input is the current of the PCC point when fault was occurred. The output was tripped signal of the breaker. So the breaker was tripped signal and the grid and pv system was island and protected the system. So the higher value of the current at PCC point is decreased and protection against the islanding for integrated grid connected pv system.

Directional Relay Algorithm



(Figure-10 Directional Relay Algorithm)

The use of above algorithm the directional relay was design for grid connected system. The relay operation worked on two types backward and forward direction.

CONCLUSION

This paper was presented on the design protection scheme against islanding for grid connected pv system. The simple over current relay and directional relay was designed for protection scheme at PCC point. But main goal was to develop the directional over current relay. So the future work was to design the directional relay for at different point for grid integrated pv system.

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