ADVANCED FUZZY MPPT CONTROLLER FOR A STAND-ALONE PV SYSTEM

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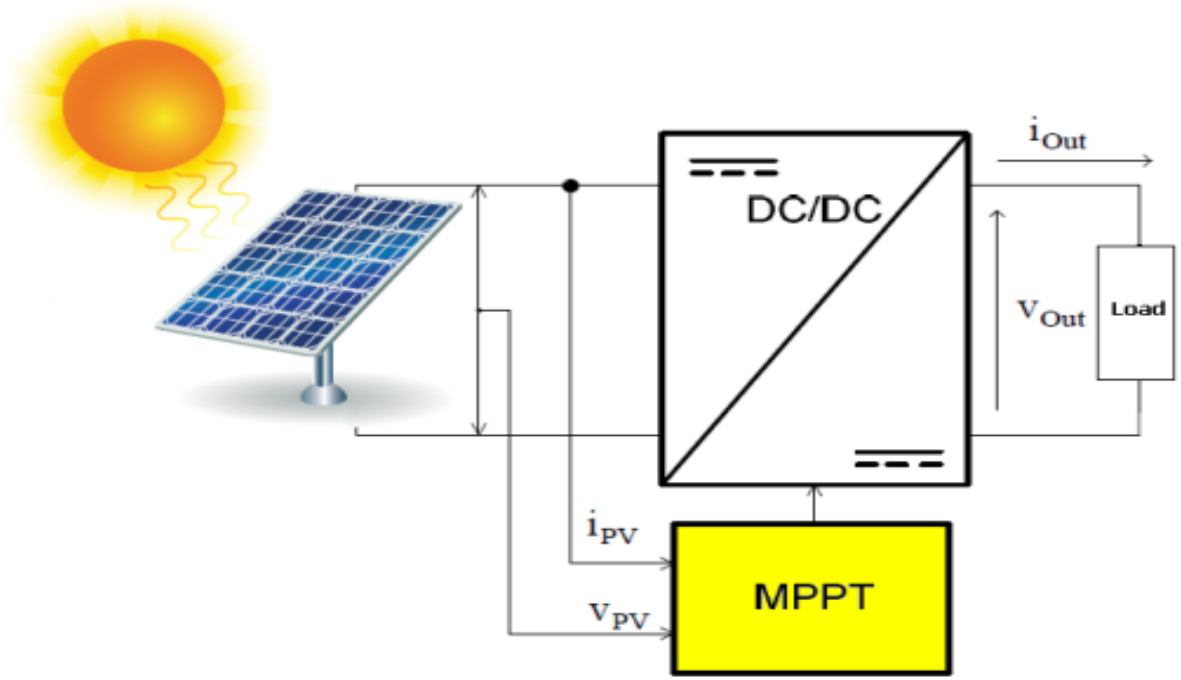
EXPLANATION OF THE RESEARCH

- Renewable energy sources are considered as a technological option for generating clean energy. Among them, photovoltaic (PV) system has received a great attention & it becomes an efficient solution to the environmental problem
- PV system cannot be modeled as a constant DC current source because its output power is varied depending on the load current, temperature and irradiation.
- Generally, MPPT is adopted to track the maximum power point in the PV system. The efficiency of MPPT depends on both the MPPT control algorithm and the MPPT circuit. The MPPT control algorithm is usually applied in the DC-DC converter, which is normally used as the MPPT circuit. Typical diagram of the connection of MPPT in a PV system is shown in Fig.



Typical diagram of MPPT in a PV System

❖One of the most popular algorithms of MPPT is P&O (Perturb and Observe) technique; however, the convergence problem and oscillation are occurred at certain points during the tracking. To enhance the performance of the P&O algorithm, we adopt the application of Fuzzy Logic Control (FLC) to the MPPT control. The simulation study in this paper is done in MATLAB and Simulink.

OBJECTIVE OF THE ABOVE RESEARCH

- Development of MPPT controller by using buck converter.
- Trace the maximum power point operation of the PV panel irrespective of the changes in the environmental conditions.
- Fuzzy logic MPP is simple to design and does not require the knowledge of exact model.

NOVELITY OF THE WORK

Fuzzy logic control (FLC) is proposed to control the maximum power point tracking (MPPT) for a three phase grid connected photovoltaic (PV) system using line commutated inverter.

LITERATURE REVIEW

Salas V, Olias E, Barrado A, Lazaro A. Review of themaximum power point tracking algorithms for stand-alone photovoltaic systems. Sol EnergMatSolC,2006;90(11):1555-78. describes that considering the surrounding condition such as irradiation and temperature, tracking of maximum power is a complicated one and to overcome this MPPT algorithms have been used.

Coelho RF, Concer FM, Martins D. A simplified analysis of DC-DC converters applied as maximum power point tracker in photovoltaic systems. 2nd IEEEInternationalSymposiumonPowerElectronicsforDistributedGenerationSystems,2010;pp.29-34. describes that the MPPT is achieved by interposing a power converter (DC-DC converter) between PV generator and battery and guarantee the operation point is being the MPP.

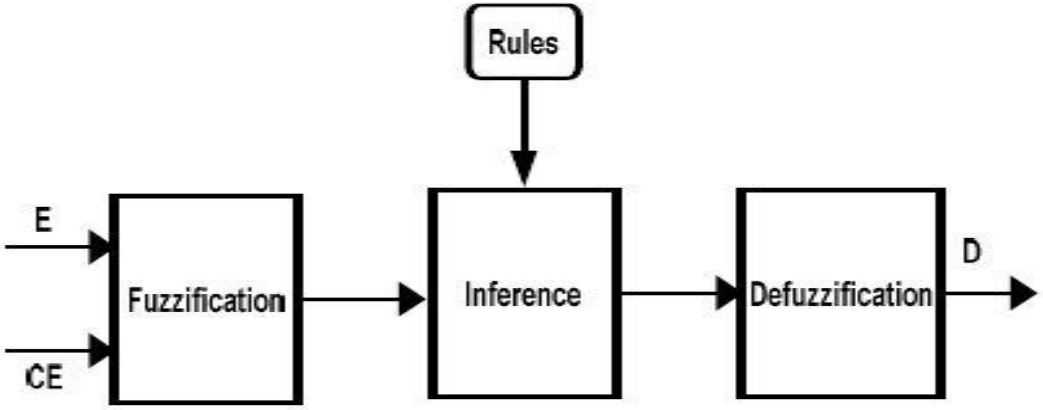
GAPS IN LITERATURE

- The implementation of three phase LCI(Line Commutated Inverter) for solar PV-grid interconnection.

- As solar PV systems integrate both the direct current mode and the alternating current mode, the control of both the DC side or the PV side and the grid side or the inverter side comes into picture. Out of the above two controls the AC side control poses more complexity and is harder to implement.

METHODOLOGY FOLLOWED

- Fuzzy Logic controller for MPPT and it is compare with the conventional P & O method.



FINDINGS

- PV generator output power ,operating voltage, operating current, and the duty ratio D using a buck converter under standard test conditions (STC) between FL based MPPT and conventional P&O MPPT.
- A rapid increase in irradiance from 1000W/m2 to 1200W/m2 within a time period of 2 seconds was simulated .The cell temperature was kept at a constant value of 25°C. Under these operating conditions the FL based MPPT method is more significant.

CONTRIBUTION OF THE RESEARCH

- A fuzzy logic controller has been developed for interfacing PV array with utility grid through a three phase line-commutated inverter.

LIMITATION

- Total harmonic distortion (THD) and electromagnetic interference (EMI).
- This circuit require an additional circuit to maintain the synchronization between converter and ac grid.

FUTURE AVENUES

- Inverter can be designed by using SMPS circuits if further implementation will happen from this project
- Further work in this area may use different MPPT method and modified algorithms for increased efficiency in fast changing environmental conditions
- Simulation of effects of PI controller on transient response for different Kp and Ki values

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