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An Optimal Method to Design a Trap-CL Filter for a PV AC-Module Based on Flyback Inverter

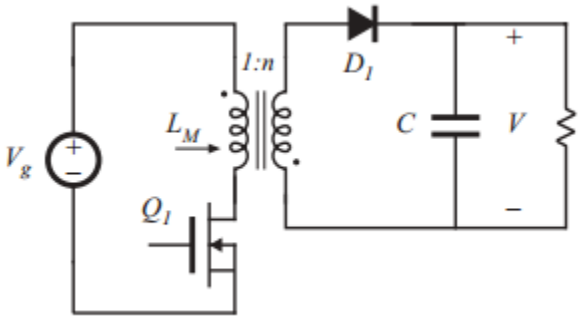
Introduction:

Photovoltaic (PV) energy has been highlighted as a next-generation energy source to solve environmental pollution and energy exhaustion. In conventional centralized PV power generation systems, a number of PV-panels are connected in series and parallel to concentrate power. In this case, the centralized power conditioning system (PCS) cannot control all PV-panels at the maximum power point (MPP) because each PV-panel has different MPPs caused by mismatch problems under various environmental conditions, such as irradiation and temperature. To solve this problem, a modularized PV system which is called the ac-module has been proposed. It has only the rated power of the PV-panel because of the installation method, which involves attaching it to the back of the each PV-panel. Thus, the size and weight are important design considerations for the ac-module. Among the various topologies of the ac-module, the flyback-based inverter topology has been recognized as an effective solution to reduce the product size due to its simple configuration.

Existing system:

The flyback converter is used in both AC/DC and DC/DC conversion with galvanic isolation between the input and any outputs. . More

precisely, the flyback converter is a buck-boost converter with the inductor split to form a transformer.



Drawbacks:

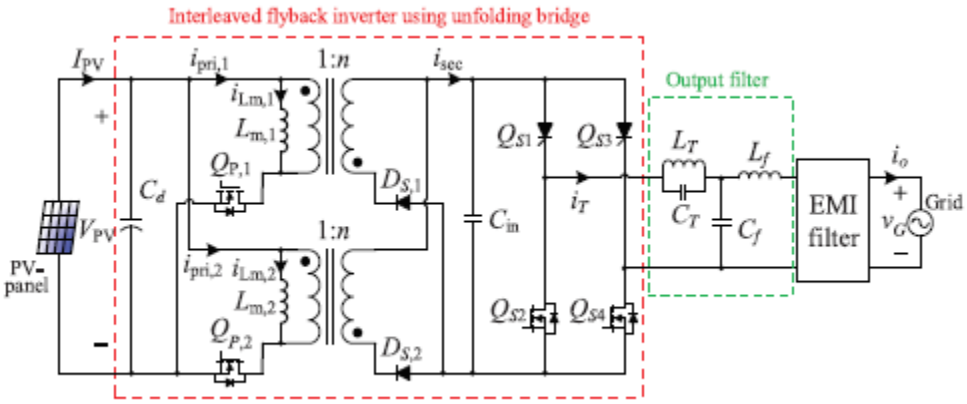
- High stress
- High filter value
- Low current gain

Proposed system:

This paper proposes a new output filter, named the trap-CL filter, to reduce the size for ac-module applications. The trap-CL filter consists of a trap filter with large impedance at the resonant frequency, and the CL filter. The trap filter of the proposed output filter is used to eliminate the harmonics at the switching frequency, which is dominant in the output current. Thereby, the required filter inductance can be reduced because the CL filter handles a smaller harmonics in the multiples of the switching frequency.

The ac-module can be divided into three parts: the flyback converter, the unfolding bridge, and the output filter. The flyback converter, which has decoupling capacitor *Cd*, performs shaping the dc

output current of the PV-panel into a rectified sinusoidal waveform in DCM operation, using the main switch *QP*, 1 and *QP*, 2. The unfolding bridge, which consists of thyristors (*QS*1 and *QS*3) and switches (*QS*2 and *QS*4), determine the direction of the output current for the grid phase synchronization. The output filter is used to attenuate the harmonics created by the DCM control. Nevertheless, the output current still contains harmonics in the EMI frequency range, because the flyback inverter tends to be operated at high switching frequency for improved efficiency.



Advantages:

- Reduce size and weight.
- Inductance and the size of the filter can be reduced.

Applications:

- AC-module applications.

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Block diagram: