

Grid-connected PV Inverter with Flying Inductor

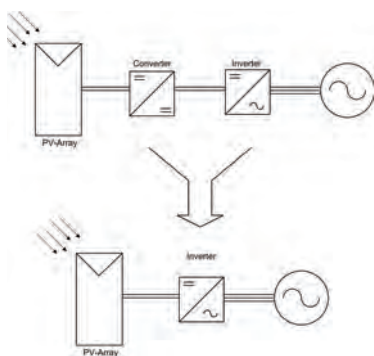
Industrial Electronics / Prof. Dr. Andrea Vezzini

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Sputnik Engineering AG develops solar inverters for line feedback. The Solarmax inverters not only feature Swiss Quality but also a good price/performance ratio. This is now to be improved further by means of the latest technology. Various topologies were examined in a preliminary study. The flying inductor topology proved very promising and was therefore pursued in this project. During the Bachelor thesis the flying inductor topology was calculated, simulated and a layout designed as a single-phase 1 kW solar inverter.

Flying Inductor

The flying inductor is a single-stage inverter topology based on a publication by D. Karschny. This describes an inverter structure which generates a sinusoidal output voltage by means of five circuit breakers. The flying inductor is not a new topology but combines three different topologies in one circuit. The main advantage of this circuit is that a reference earth exists throughout due to common ground technology so that the input is on the same potential as the output. Therefore newer thin-film modules can be connected without additional circuitry work.



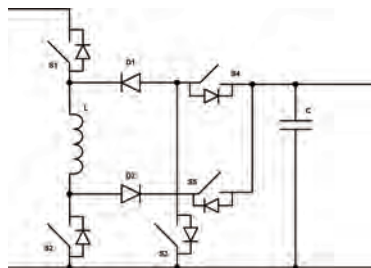
Design of a single stage inverter

Simulations/Evaluation

Different simulations were carried out with MATLAB/Simulink and PLECS during the study. Here the principle function of the flying inductor and its control were verified and the software process of the control was simulated. Different calculations were made for dimensioning of the flying inductor and then optimised based on the simulations.

Software

The F28027 Piccolo fixed-point DSP controller from Texas Instruments from the TMS320 series was used to control the software. The entire software and control of the flying inductor was developed new for this project. The software for the DSP was written in C and controls the circuit breakers and takes over the complete control of the flying inductor.



Schematics of the Flying Inductor

Hardware

The newly developed hardware was adapted to a Solarmax inverter of the S-series. It was a challenge to find appropriate components for the voltage and current ranges so that they would be available and as inexpensive as possible by the end of the study. Therefore the partial circuits used in the S-devices were modified so that some components could be adopted. The schematic and layout were created with the Altium Designer in order to produce a circuit board for the prototype as quickly as possible.

Aim

The aim of this study was to gain a cost advantage by new technology without losing any of the quality or efficiency. Therefore a prototype was to be developed and produced in order to be able to make a clear statement about the flying inductor topology in this form based on measurements and tests.



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