Resumen de Tesis Doctoral

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(Mínimo 1 y màximo 4, podéis verlos en http://doctorat.upc.edu/gestion-academica/carpeta-impresos/tesis-matricula-y-deposito/codigos-unesco)

Resumen de la tesis de 4000 caracteres máximo (si se superan los 4000 se cortará automáticamente)

Electrical energy generation systems based on renewable energy sources have been promoted in recent years. The introduction of these systems has changed the centralized energy model to become a distributed energy model. The variability, more or less predictable, in electrical energy production based on renewable energies is a particularity of some distributed power generation systems. These variations, due to the nature of the power source, are a further disadvantage when considering the variability in energy demand. The fluctuations between energy generated and energy demanded makes it necessary to increase the use of power electronic systems in order to manage energy by storing the excess of energy during times of low demand and injecting to the grid when higher demand requires it. Some electrical energy generation systems are not able to manage variable power flow, for this reason the efficiency and their influence on the grid must be considered when their operating regime is variable.

This thesis is framed within the field of electrical energy conversion in power generation systems based on renewable and non-manageable energy resources. This research scope focuses on the impact in terms of efficiency of power converters when their switches are based on transistors connected in parallel operating in case of variable power flow. Therefore, this thesis explores the energetic efficiency converters considering the influence in the current distortion by measuring the Total Harmonic Distortion (THD). To evaluate these parameters a switching strategy has been developed providing advanced configuration capabilities, selecting the number of transistors within the power switch according to the operating conditions of the power converter, applying switch multiplexed techniques and adaptive control strategies. Two main strategies are developed according to the switching frequency, maintaining a constant switching frequency in the power converter or maintaining a constant switching frequency in the transistors within the power switch. Both of them can decrease the number of switchings in each transistor.

A study of performance of transistors connected in parallel is presented, highlighting the factors involved in the transistor current sharing, examining the existing techniques and analyzing their influence in transistor losses. Loss estimation models are introduced to evaluate the effects of the adaptive switching techniques on two of the main devices of the power converter, the transistors and the grid coupled inductor.

The experimental results are obtained from a single-phase inverter with power switches based on four transistors connected in parallel. The test results show the power losses in different operating conditions, distinguishing the conduction losses, the switching losses and the losses due to the coupling inductor.

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