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(Mínim 1 i màxim 4, podeu veure els codis a http://doctorat.upc.edu/gestio-academica/impresos/tesi-matricula-i-diposit/codis-unesco)

Resum de la tesi de 4000 caràcters màxim (si supera els 4000 es tallarà automàticament)

Galvanically-isolated bidirectional dc-dc converters (IBDCs) have recently received more attention due to its increasing use in systems requiring energy transfer between two dc networks in both directions, requiring galvanic isolation and a high voltage gain. Some of these systems are energy storage systems, vehicle-to-grid power interfaces, fuel cell energy systems, uninterruptable power supplies, high-voltage dc links for electric-energy transmission, and solid-state transformers.

The most prominent IBDC, thanks to its good performance, is the dual-active-bridge (DAB) converter. It features a high power density, a wide dc-voltage gain working range, a low count of passive components, and an exceptional transformer utilization. Nevertheless, the DAB converter suffers from a significant performance deterioration when operating at conditions different from its nominal design working point. This problem has been alleviated by designing complex modulation schemes, which require a high computational effort and are highly dependent on the parasitic-component values.

On the other hand, as DAB converters have been lately introduced in high-power applications, higher voltages are needed in the dc links in order to achieve reasonable efficiency values. This has led to the use of multilevel topologies on the DAB converters, mainly multilevel neutral-point-clamped (NPC) topologies. However, the little and recent literature in this topic have not fully explored the operational capabilities and performance benefits of multilevel DAB converters.

The aim of this thesis is to study the viability of multilevel NPC DAB (ML-DAB) converters, where the major faced challenge is the dc-link capacitors voltage balancing. First, three particular ML-DAB converters are studied, with the same number of levels on each side; the three-level, four-level, and five-level topologies (3L-DAB, 4L-DAB, and 5L-DAB, respectively). Suitable switching sequences, modulation schemes, and control schemes are designed for the proposed ML-DAB converters. The converter switching and conduction losses are studied with three figures of merit, resulting in a set of practical solutions that define the modulation parameters and achieve satisfactory converter-performance figures. These results are then generalized to the N-level topology (NL-DAB). Finally, the feasibility of ML-DAB converters with an asymmetric number of levels is also demonstrated.

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