Abstract

The bidirectional DC-DC converters are being used more frequently in electric power systems. Bidirectional converters allows the incorporation of alternative and renewable energy sources at different voltage levels, by means of new power systems architectures now distributed not only centralized.

The converters control is defined by function within the system, especially when there are large differences in voltage levels. It is desirable that the converter provide galvanic isolation, control current and / or voltage at one or both buses, and in some cases provide multi-port bidirectional conversion.

One of the topologies with high power density is the single phase *Dual Active Bridge* (DAB). This thesis presents a study of a single phase DAB phase shifting controlled to meet the requirements of a bidirectional DC-DC converter for storage, parallel operation capability, high power density and fast dynamic response.

The modularity of the DAB and the parallel operation arises from the conception of a control loop of Average Current Control (ACC), a double loop that controls the voltage and current of the high voltage side or controls the current and voltage at low voltage side.

The dynamic response of a DAB to load steps are improved by means of a feedforward technique based on load current, an additional load-current feedforward control loop. An analytical study of the load-current feed-forward on DAB is presented and validated by means of both simulations and experimental results.

The DAB topology exhibits a high input and output AC current ripple, especially at low voltage side. This thesis studies parallel connection by interleaving an average current control, based on two or more modules DAB operated synchronously but shifted in phase, in order to reduce the AC current and the capacitors size.

The design has been validated by means of the implementation and testing on a 1 kW DAB converter at a switching frequency of 100 kHz.