

Power Electronics for automotive applications

Robust Bidirectional CLLLC High Voltage DC/DC control for automotive onboard charger

VITESCO Technologies develop a system approach for a robust control law development which guarantees the right performances of its on-board charger whatever the HW solutions, the component dispersion, manufacturing spread and the worldwide grid network disparities.

Two stage automotive on-board chargers are built with a power factor correction (PFC) stage connected on one hand to the grid and on the other hand to a DC/DC stage which is finally connected to the traction battery.

To deal with vehicle to grid, vehicle to load and vehicle to home development Vitesco Technologies use a high efficiency bidirectional DC/DC based on CLLC technologies.

For cost effective fulfillment, it becomes more and more important that a single on-board charger product covers the main grid configurations over the world (EU, EU, CN, JP...) and as usual also considers the production spread on top of this. These requirements have a strong impact on the controller's robustness.

The project target is to develop a DC/DC control structure to ensure an accurate battery current regulation with an optimal damping ratio to mitigate current overshoot (lower than 10%) and ensure a reverse current transition in less than 100ms to satisfy the V2G requirement (grid network stability power profile). The challenging systems parameters are the resonant capacitors production spread ($\pm 5\%$), high frequency transformer production spread ($\pm 2.5\%$), wide traction battery voltage range (ex: 360V...860V), temperature dependency and the charging power (500W...11kW).

In order to address this problem, VITESCO will work with the LAPLACE laboratory and in particular its CODIASE team, which has extensive experience in the field of static converters.