# Robust Battery Module Integrated Converters for Maritime Applications

## Master thesis project




**Summary:**

The aim of this thesis is the use of a distributed module integrated power converter architecture (single pack converter) with a decentralized module power converter building block.

**Problem definition:**

Like microinverters can increase the efficiency and reliability of solar panels, battery modules can be operated in parallel as opposed to strings as is commonly done in the marine business. Marine applications often use high bus voltages to keep the currents manageable. However, if one battery module fails, the whole string is lost. As these strings are often a substantial capacity, this would impact the total performance of the ship.

**Method:**

In this study, we wish to investigate the use of single-pack converter, all batteries which can topologically work in parallel, while maintaining a high bus voltage. A switching approach can be investigated as well.

**Research objectives:**

1. Perform a literature survey on LiB-based battery solutions for maritime applications and a modular concept for integration to a dc bus/ ac bus in maritime applications
2. Study several parameters including voltage levels, scaling, energy and power density and relevant KPIs for the dc/dc or dc/ac converter for such an application
3. Model the system using PLECS and consider benchmarking a typical most-suitable topology and compare with high-performance, low-loss topological options
4. Perform simualtions and build a suitable protype for the same application and perform lab-scale testing
5. Validate the design using experimental analysis and perform electrical characterization and performance parameters (efficiency, losses, integration with dc/ac link respectively on choice)

**Courses and supervision:**
This is a a challenging, hands-on power electronics project. Background of EE and power electronics and battery-related courses are considered mandatory.

---

**Contact:**

Dr. Prasanth Venugopal (PE) prasanth.venugopal@utwente.nl, Prof. Thiago Batista Soeiro t.batistasoeiro@utwente.nl