OPAL-RT TECHNOLOGIES

Success Story

The impact of Real-Time Simulation on the Development of Marine Power Systems at Aalborg University

1. Context

Global concerns over pollution and greenhouse gas (GHG) emissions have led to stricter regulations in the maritime industry, which has, in turn, led to increased efforts to make onboard energy systems more efficient. Aalborg University's Marine Power Systems Laboratory of relies on state-of-the-art real time simulation and reduced scale experimental platforms to design, test, and validate the integration of new technologies into various types of marine vessels, such as drilling, transport, and naval. Developments are made according to the most recent marine class regulations.

2. Challenge

Over the last few years, we have seen an increase in the development of the electric propulsion in the maritime industry. These electric propulsion systems, which are usually hybrids, involve the integration of several converters into the ship's onboard electrical system. The main goal for these converters to ensure the stability of the on-board power supply network and to drive the electric motors responsible for propulsion. These systems are getting more and more complex and require thorough testing and validation before being deployed in actual ships.

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3. Solution

The best way to test and validate this type of converter is to use real-time simulation. The laboratory facility currently uses the advanced OPAL-RT 12-core real time simulator, which is fully compatible with Matlab/SimPowerSystems and can be used for a broad range of onshore and offshore applications, such as:

- Real-time simulation of complex electrical networks on paralleled CPU cores.
- Real-time simulation of converter topologies on FPGA board.
- Interfacing with power amplifiers to test the impact of physical equipment (either power hardware or controller prototypes) on simulated infrastructure.
- Designing rapid control prototypes.

4. Conclusion

The OPAL-RT real-time simulator allows Aalborg University's Marine Power Systems Laboratory to emulate the detailed converter operations, which makes it possible to test and validate different controls both separately and across validation systems.

Real-time simulation allows R&D centers to design better converters in less time and it can also be used for other applications, such as: customer training, where it is preferable to use simulation rather than a real ship, and maintenance, since real-time simulation makes it possible to replicate a breakdown and to investigate the cause without stopping the ship.

5. Testimonial

"Real time simulation helps us obtain a better understanding of the dynamic phenomenon and to observe the correlation between the different variables in a complex electrical power plant. With this knowledge, we can get a clear "big picture" that allows us to design better performing systems.

The OPAL-RT simulator also gives us the ability to make initial Hardware-in-the-Loop verifications of new functionalities based on latest maritime class regulations that are to be integrated on the shipboard power systems."

Dr. Tomislav Dragičević, Associate Professor
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