# Real-time Marine Vessel and Power Plant Simulator

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During the last decades diesel electric propulsion in combination with dynamic positioning has become industry standard for some types of vessels such as drilling rigs and offshore service vessels. With diesel electric propulsion, diesel engines are connected to generators to produce electrical power. This power is fed to among thrusters to keep the position and heading of the vessel. To be able to simulate the performance of a vessel a model which contains both the mechanical system (diesel engines, thrusters, and vessel) and the electrical part is needed.

Such a simulator can model the load fluctuations due to change of thrust demand from DP, this is crucial for the design of both the electrical producers and the DP controller. An interconnected simulator between the electrical power plant and the vessel model is needed to check how a fault in the electrical position will influence the vessel during the first minutes after a fault in the electrical power plant. During the years many new ideas has been proposed, with AC, DC, and a hybrid combination. Such a simulator can therefore be used to check and optimize performance of new methods.

The main contribution of this simulator is the interconnections. Earlier work has mainly been done by simulating isolated system. However, this simulator includes a vessel model including waves, current, and wind; DP control system with thrust allocation and observer; and an electric power plant model with diesel engine model, generators, thruster drives, and a power management system. The simulation is able to run in real time, which means that it can be used for hardware-in-the-loop testing of control system. The simulator is made in Simulink, while ACADO is used for the controllers which need an optimizer, and cRIO is used as hardware for real-time computation.

The simulation toolbox allows AC, DC, and a hybrid power plant including batteries. Some model are implemented with both high fidelity and low fidelity models, such as diesel engine which is modeled with mean value models and a model using industry standard rate constraints and mapping of efficiency. Fault handling can be simulated since a power management system is included; it includes fast load reduction and power available.

In this article we will presents the models and show some simulation results from cases where faults on the electrical power grid gives restrictions on the available thrust of the DP system.