

RT-LAB Application Example

Real-time simulation of a shipboard, multi-machine power generation system

Keywords: Shipboard Power Generation System

The modeled system, shown in the figure below, is composed of two generation-groups and five induction-machine drive loads interconnected by a DC bus. Each generation-group includes four ideal sources behind R-L circuits rated 230V at a frequency of 60Hz. The AC voltage provided by each generator is rectified by a 6-pulse ideal diode rectifier with R-C snubbers and is isolated using a Yg-Y transformer of unary windings ratio. The diode rectifier that is used is the SPS Universal bridge model. Short decoupling lines (stublines) are essential for real-time performances as it produces decoupling of the underlying computational models. In order to lighten the calculation load of the two CPUs assigned to the generation groups, the system is decoupled by one stubline at the end of each rectifier.

Every load component is a squirrel cage induction motor, rated 4 HP at 220V and 60 Hz, fed by a DC/AC converter, isolated with a unary windings ratio Y-D transformer. They are all rotating at constant speed hence mechanically coupled to an infinite mass. The three-phase, 2-level inverters are Time-Stamp Bridges from the RTeDrive Blockset and are each gate-controlled by an RT-Events PWM generator (constant frequency modulation ratio and constant amplitude modulation ratio).

Stublines simulate the smoothing reactors in order to provide a virtual separation of the subsystems (each subsystem is assigned to a single CPU). The model capacitors (C1 to C5) have large values and provide the smoothing and stabilization of the DC bus voltage.

The model was simulated in real-time at a time step of 20 μ s on a dual quad-core PC running under RT-LAB. Tests have shown the accuracy of the stubline and TSB models at even larger time steps. These tests permit to conclude that a time step larger than 20 μ s could be used (on a lower cost 4-core system, for example) because the model is still accurate in the 50-70 μ s time step range.

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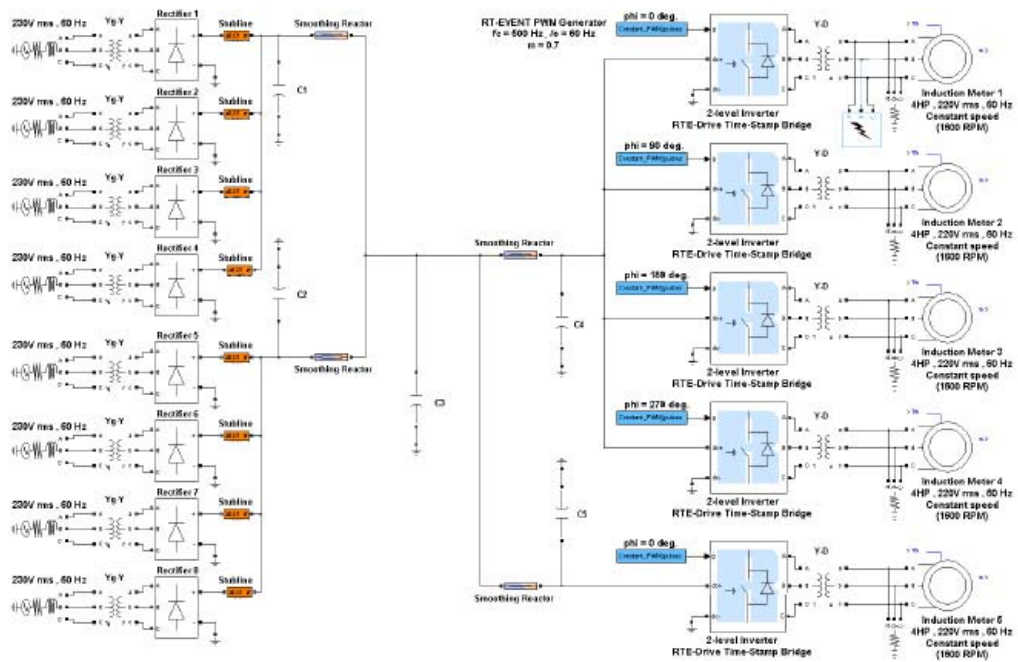


Figure 1. Shipboard Power Generation System

Solution configuration	
Solution package	eMEGAsim
Hardware enclosure	8-CPU HILBox
Software modules	RT-LAB, Time-Stamped Bridge, RT-Events, ARTEMIS