PROJECT 7 – NATURAL-GAS BASED HYBRID POWER SYSTEMS FOR VESSELS

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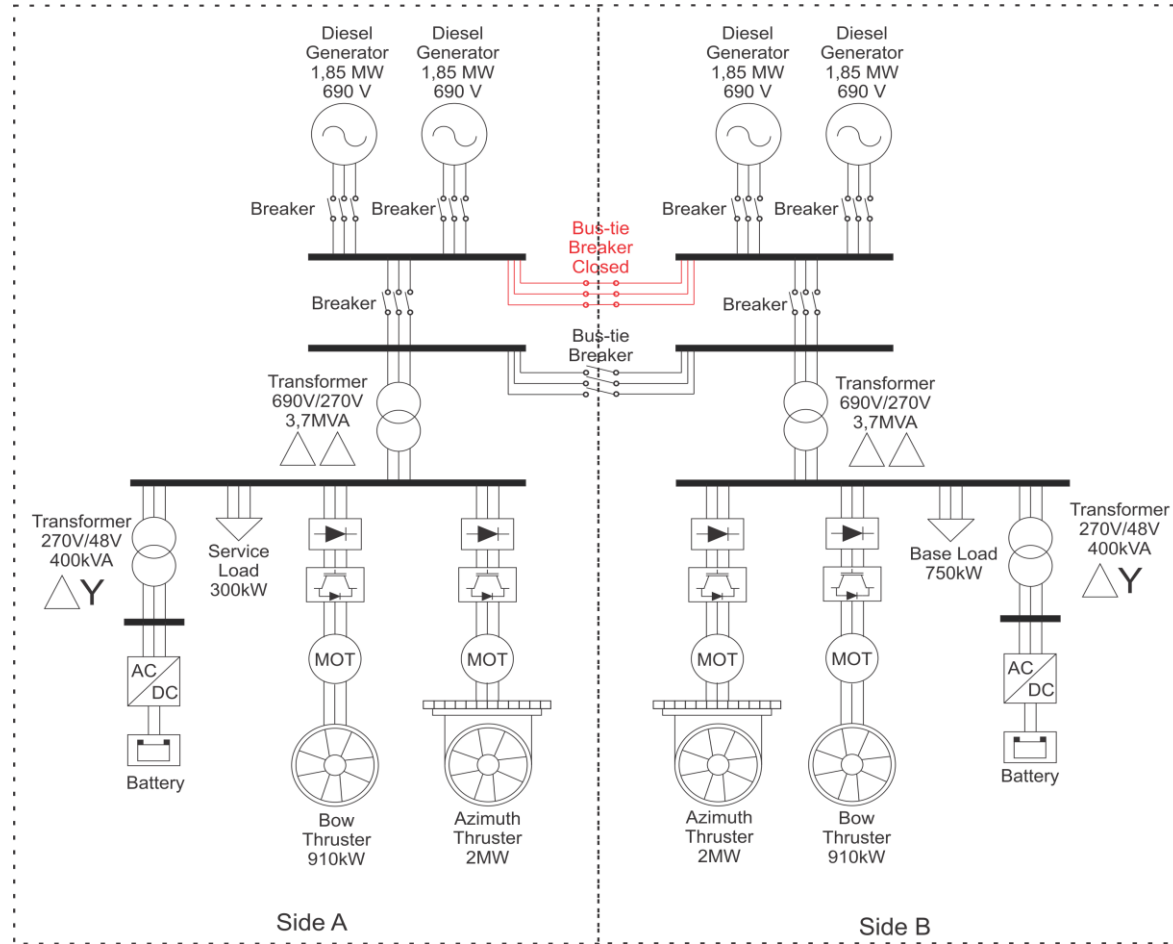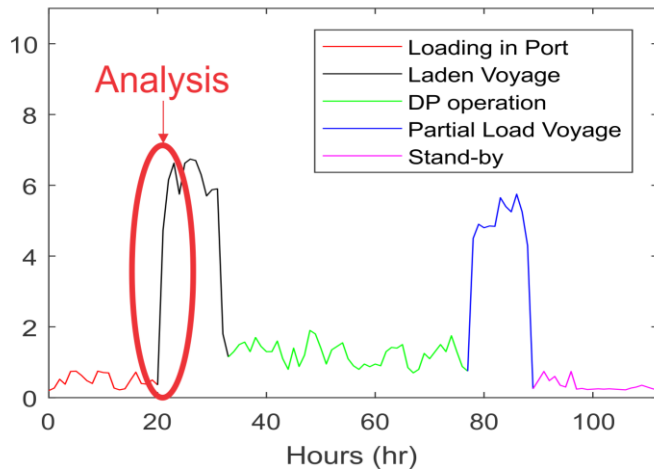University of São Paulo, Brazil
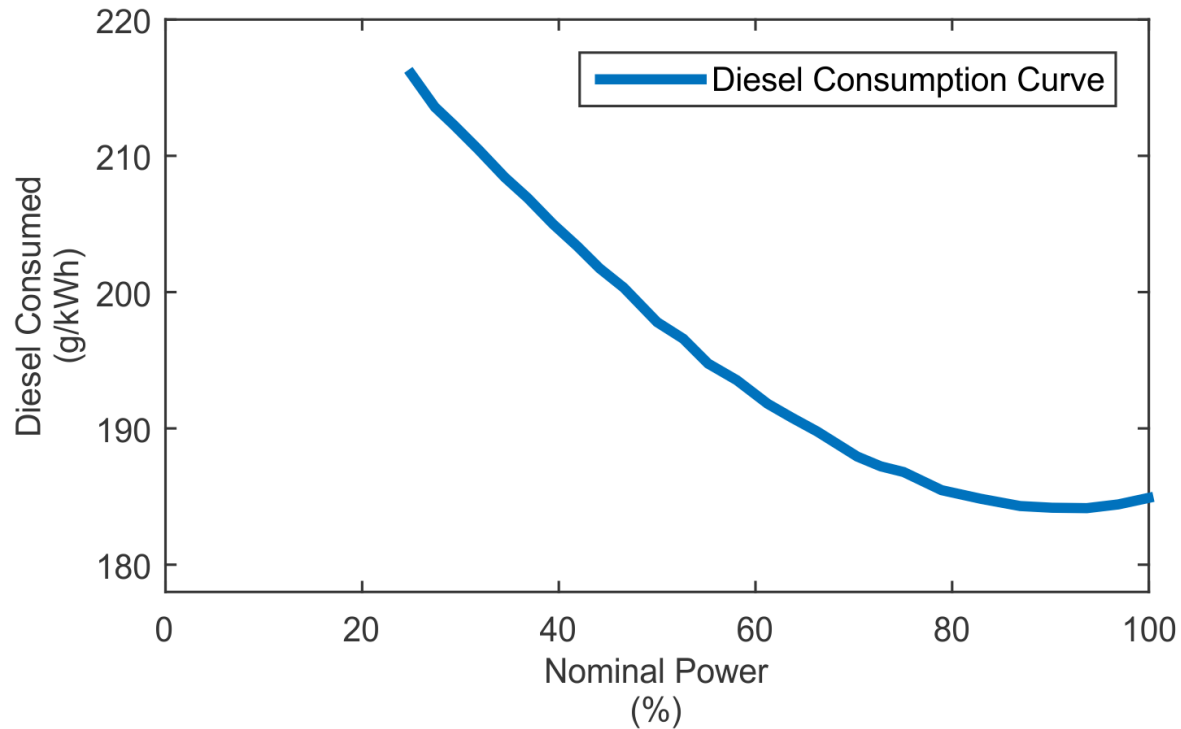
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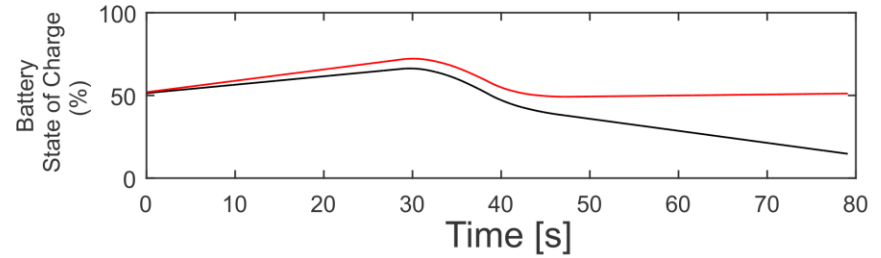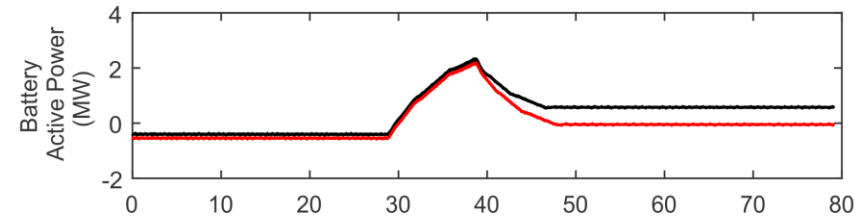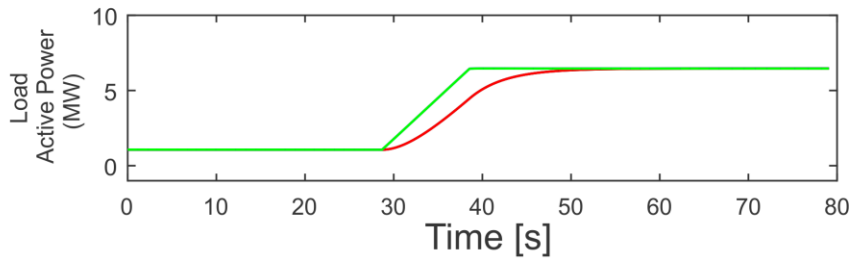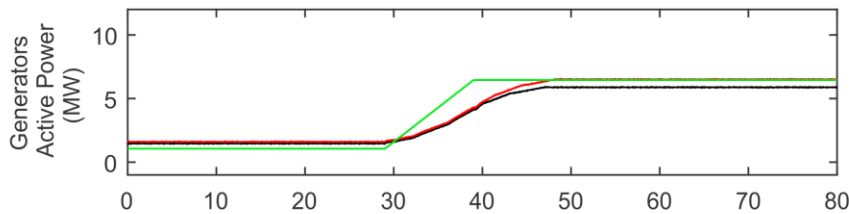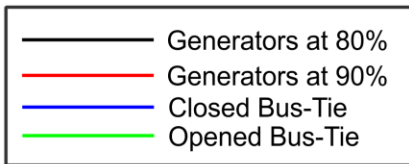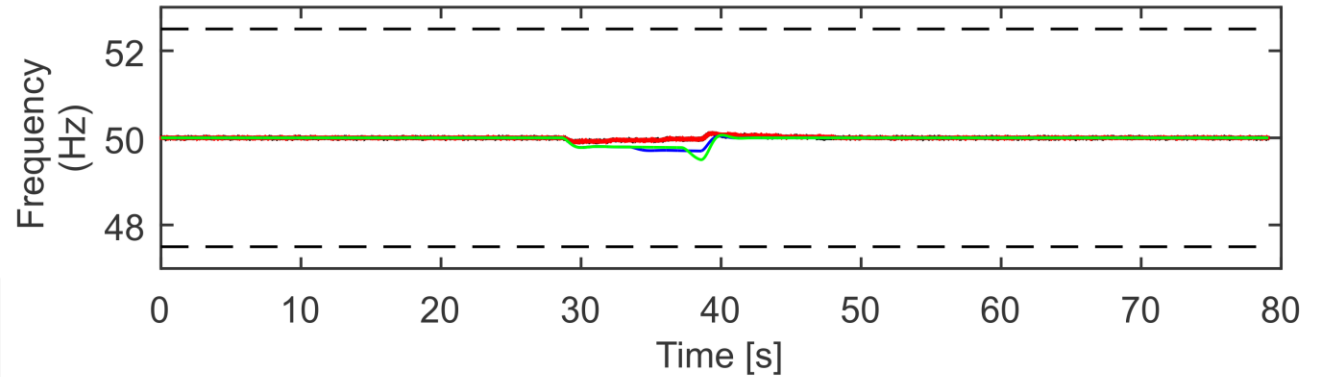21 – 22 AGO DE 2018

Frequency Control via Battery

Diesel Consumption Curve

Results

Reduction on diesel consumed and CO2 emitted

Case	Reduction on Diesel Consumed (%)	Reduction on Total Diesel Consumed Battery Charge +Operation (%)	Reduction on Total Diesel Consumed Battery SoC (final-initial) +Operation (%)
Bus-tie Opened	-	-	-
Bus-tie Closed	16.15%	16.15%	16.15%
Generators at 80%	17.72%	-1.17%	4.24%
Generators at 90%	18.16%	-0.93%	17.86%

| Case	Reduction on CO_2 emitted (%)	Reduction on NO_X emitted (%)
Bus-tie Opened	-	-
Bus-tie Closed	16.15%	16.15%
Generators at 80%	17.72%	17.72%
Generators at 90%	18.16%	18.16%

Requisites for TPN incorporation

- Preferable language – Matlab
- Runtime actualization frequency – 10 Hz – 0.1 s
- TPN input
  - Required shaft velocity
- Model output
  - Propulsion force

Work inherited from the research group

- Motor thermodynamics model
  - Dr. Silvio de Oliveira Junior, Roberto D. A. Campos

- Optimization of the hybrid model structure
  - Dr Maurício C. B. Salles, Cesar P. O. Piernagorda

- Motor electric parameters
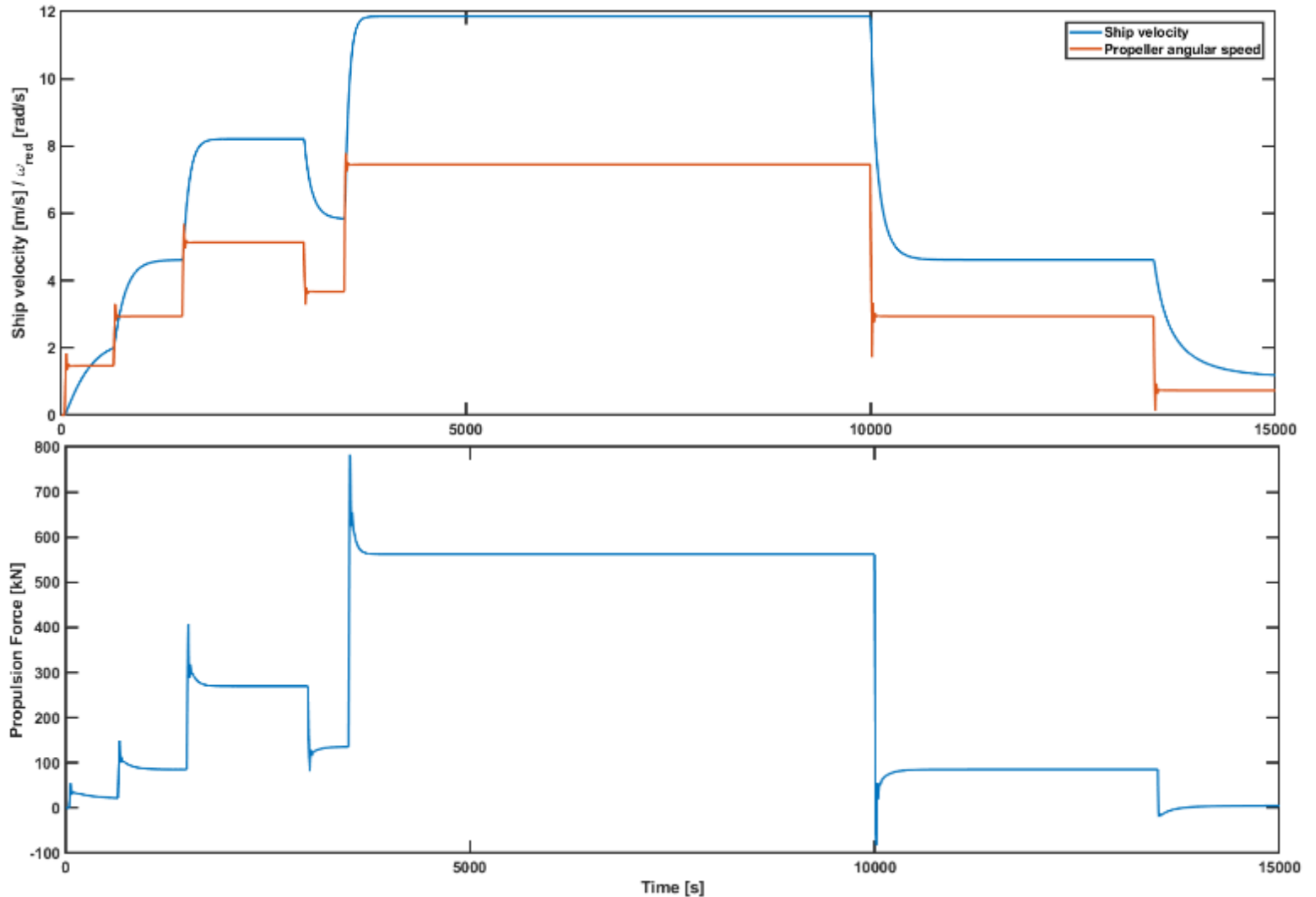 - Dr Maurício C. B. Salles, Giovani G. T. T. Vieira
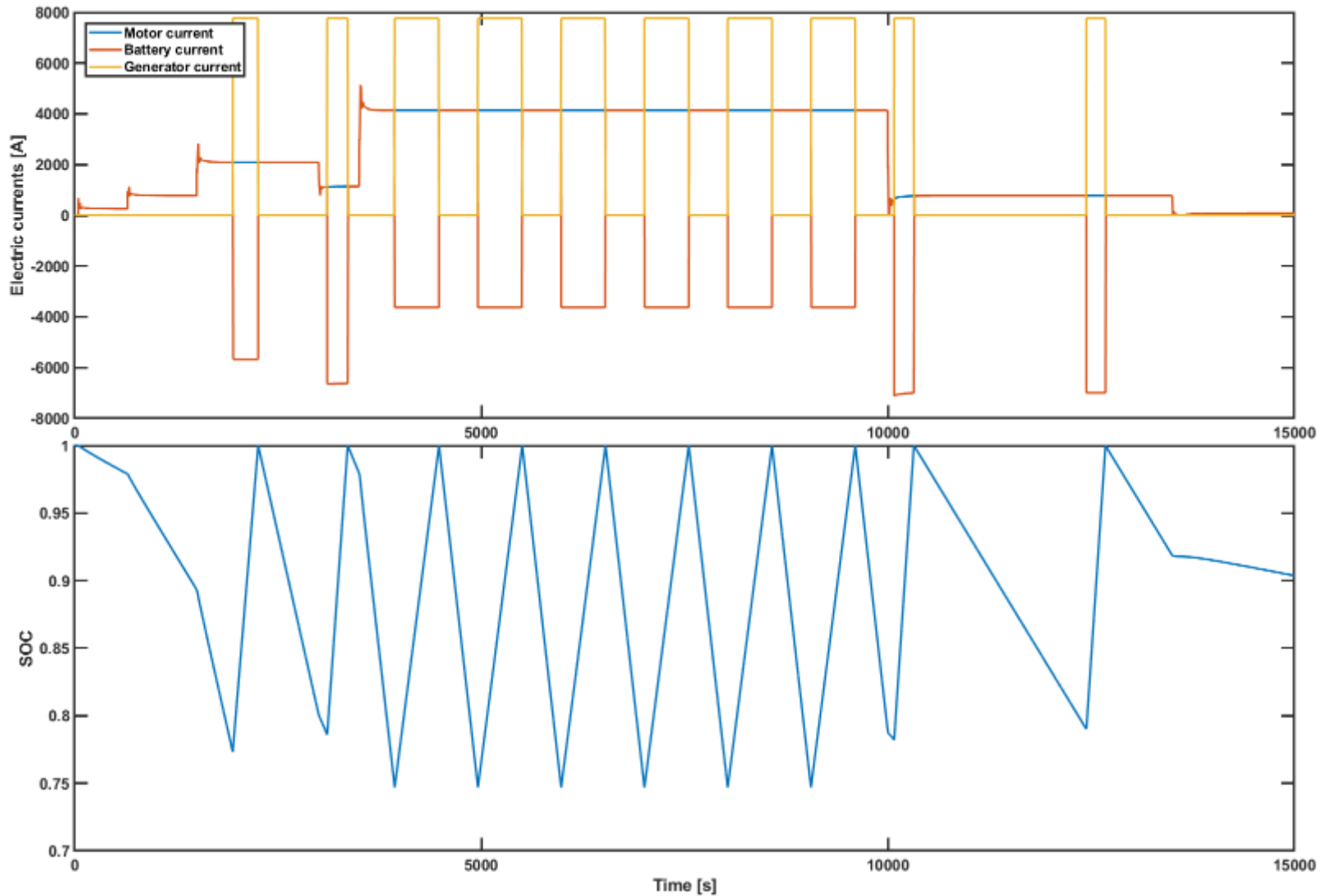
TPN - Hybrid System model
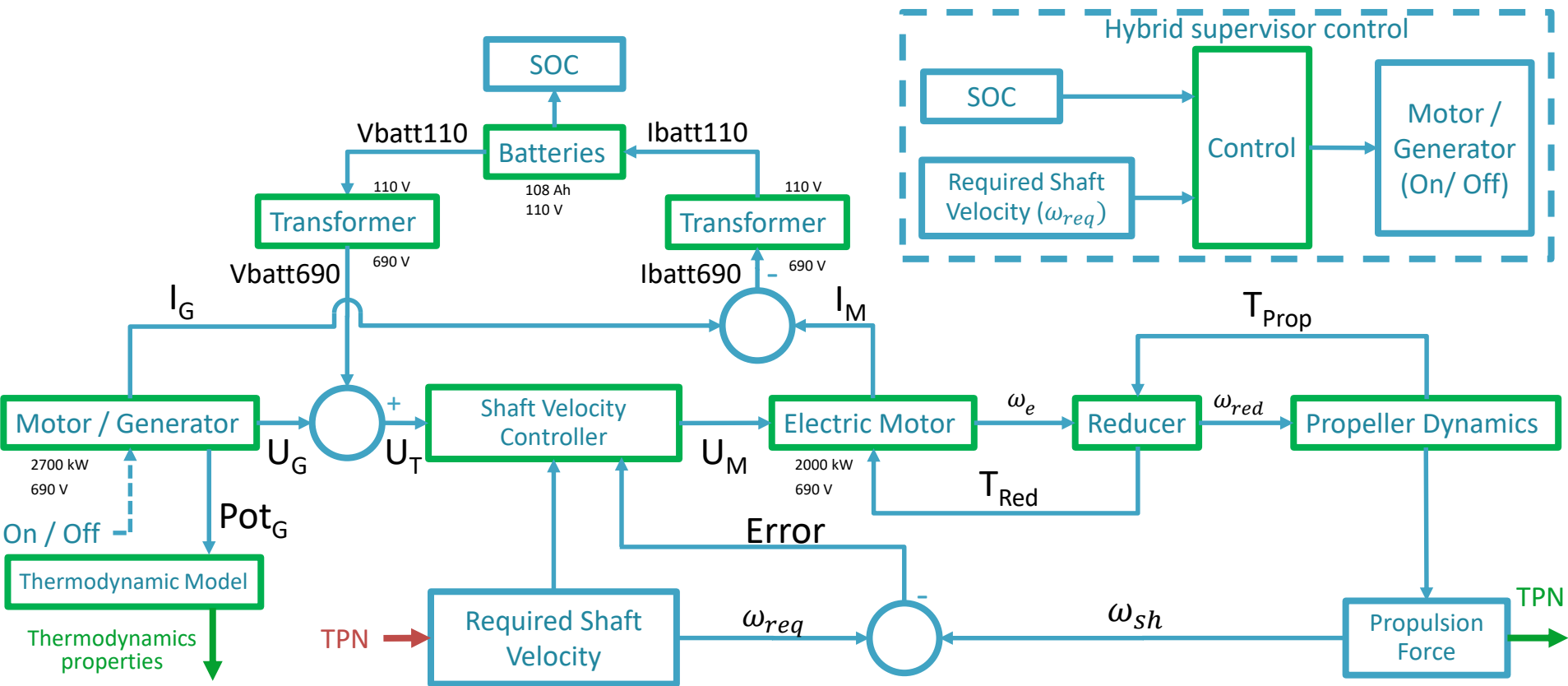
Simulation

- Ship characterization
  - Type: Platform supply vessel (PSV)
  - Length: 87 m
  - Lightweight: 5 ton

- Propulsion power characterization
  - Electric motor power: 2 MW
  - Combustion generator power: 5.7 MW
  - Batteries power: 1.4 MW

Simulation results

Simulation results

Simulation results

- Trip duration – 4 h 10 min
- Trip distance – 116 km
- Total simulation time – 1923 s
  - Average Step time – 0.012 s

Simulation results

- Thermodynamic model results
    - Diesel mass: 29 kg
    - LNG mass: 1.2 ton

    - CO_2 emission mass: 3.3 ton
    - N_2 emission mass: 33.8 ton

    - Average combustion generator efficiency: 45.14%

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