# Naval Ship Propulsion and Electric Power Systems Selection for Optimal Fuel Consumption

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Although propulsion and electric power systems selection is an important part of naval ship design, these decisions often have to be made without detailed ship knowledge (resistance, propulsors, etc.). Propulsion and electric power systems have always had to satisfy speed and ship-service power requirements. Nowadays, increasing fuel costs are moving such decisions towards more fuel-efficient solutions. Unlike commercial ships, naval ships operate in a variety of speeds and electric loads, making fuel consumption optimization challenging.

This thesis develops a program in Matlab® environment, which identifies the propulsion and ship-service power generation systems configuration that minimizes fuel consumption for a given operating profile. Mechanical-driven propulsion systems with or without propulsion-derived ship-service power generation, separate ship-service systems and integrated power systems are analyzed. The program comprises modeling of hull resistance using the Holtrop-Mennen method requiring only basic hull geometry information, propeller efficiencies using the Wageningen B series and prime movers fuel efficiencies. The program provides the flexibility to skip the hull resistance estimation and the propeller selection parts, depending on information availability. Propulsion and ship-service power generation systems configuration is optimized using the genetic algorithm.

ASSET's model of DDG-51 Flight I destroyer was used for modeling validation. Optimal fuel consumption results are compared against the existing configuration for DDG-51 Flight I destroyer using a representative operating profile.

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