TOP TEN

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OnDyna - Optimal design tool for hybrid marine powertrains

Increasing concern over air quality in maritime areas is pushing towards the adoption of stringent regulations, such as the 2021 adoption of a Nitrogen oxides Emission Control Area in the Baltic Sea, requiring ships to satisfy IMO Marpol Tier III standards. In this context, diesel-powered ships for short-distance transport (i.e., ferries) might benefit from electrification. Indeed, they typically emit more when operating in highly dynamic conditions, and this behaviour can be damped by hybridising the powertrain. However, selecting the optimal hybrid powertrain is a complex and challenging task due to the large design space stemming from the variety of architecture topologies (i.e. the number, position and function of the electrical machines) and component sizes. In order to tackle the challenge, this project presents a powertrain optimal design tool for diesel-hybrid vessels, which rapidly compares a large number of hybrid powertrain layouts with various topologies and component sizes. Different design objectives can be targeted, including pollutant emissions. These are strongly dependent on the energy management strategy, which defines how the different power sources are operated. To decouple the design of the energy management strategy from that of the powertrain, the former is handled for each design candidate by a dynamic programming algorithm ensuring an unbiased comparison between them. The tool developed by this research would have several applications. It would allow designers to eliminate the first layer of complexity by identifying the optimal hybrid candidate based on their application. On the other hand, it would permit policy-makers to assess the potential impact on air quality of ferry fleet hybridisation.