News point

Dual Fuel Engine technology and dynamic Behaviour Improvement for Marine Application BIMA

The marine sector is heavily dependent on Heavy Fuel Oils (HFOs) and unfortunately, a shift to greener fuels presents significant challenges due to the scale of the sector, the proven track record of HFOs in service and the capital cost incurred when converting to other options.

Nonetheless, increasingly stringent marine emissions standards are placing larger pressures on the marine industry. The International Maritime Organisation (IMO) has targets such as the reduction of carbon emissions from all vessels by 40% by 2030 when compared to 2008.

Liquefied Natural Gas (LNG) is an attractive alternative fuel to heavy fuel oils. LNG is recognised as a zero sulphur and low carbon fuel therefore has direct positive effects at reducing polluting oxides of nitrogen and sulphur and greenhouse gas emissions.

The adoption of LNG comes with certain challenges. First, the capital cost of replacing HFO engines with new LNG engines is considerable. Given that many ships operate HFO (marine diesel) engines, a viable solution is instead to convert existing engines to dual fuel operation. With this solution, the capital cost is significantly reduced since the majority of the original engine is utilised and the engine is converted to operate with a mix of diesel and gas (LNG) simultaneously (dual fuel operation). In this manner, gas replaces most of the original liquid (diesel) fuel with the remaining fuel portion being the pilot diesel used to initiate combustion under compression during the piston compression stroke.

The challenge that emanates from such a strategy is the controlled combustion of LNG, in engines which were originally designed to operate with diesel fuel only. Without careful design, engines may operate poorly and may either knock or misfire with a very narrow operating window between the two extremes. Such control is also dependent on the operational requirements imposed by normal service operation, such as cruise, manoeuvring and weather conditions.

Research at the University of Malta is investigating the in-service operation requirement imposed on a typical marine engine in order to assess the current feasibility of dual fuel engines in terms of operation and also improve the behaviour of such engines through modern control techniques. This Research is being funded through the SINO MALTA Fund 2021 16 and is being done with Gozo Channel as an industrial partner.

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Data from ferry trips between Malta and Gozo, provided by the Gozo Channel Company Limited is used to analyse typical power requirements imposed during typical operation. This data is being used to simulate and identify the projected fuel consumption for both diesel and dual fuel operation and thus quantify the resulting emissions and highlight the environmental benefits.

The research will progress to model and simulate diesel and dual fuel marine engines to study such engine performance under different conditions and ultimately seek to establish a control strategy that enables efficient dual fuel operation for marine diesel engines.

The research is being conducted in collaboration with the Gozo Channel Company Limited, Harbin Engineering University, (city) China and Henan Diesel Engines Industry Co. Ltd, (city) China.

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