

Digital Twin of an Internal Combustion Engine

Abstract: Major marine engine companies such as Wartsila have developed both their new 4-stroke and 2-stroke using gas and hence strongly believe that Internal Combustion Engines (ICE) have place in marine power propulsion and auxiliary units. A recent announcement that Mazda sees a bright future for ICE is also indicative of automotive industry has not lost hope on the future of ICE. This paper reports on recent developments to develop a digital twin of these power units with a view to improve their performance and also as a means of monitoring their behaviour when changes are introduced. This paper is composed of two parts. Part 1 is the digital half of an Internal Combustion Engine (ICE) which concerns the development of the mathematical model of the ICE and a suite of computer simulation programs which would allow the effects of various design and operational changes to be reliably and accurately predicted with the ultimate aim of producing cleaner engines and/or more efficient power units. The model has been tested against the experimental results of the Paxman engine at Newcastle University and earlier against the Atlas engine at Ricardo, Brighton, UK. Part 2 contains the other digital half of the ICE which describes the rig development viz., the physical model of the Engine. The idea is to match the two parts using an earlier model developed by Ziarati (2009) to produce a finger print of both the mathematical model and the physical model. The matching of both parts would enable the mathematical model be used for various design and operational changes with a view to reduce fuel consumption or engine harmful emissions. The predicted results and the experimental data are in good agreement.

The Full paper is being prepared.