PhD Studentship in Naval Architecture, Ocean and Marine Engineering

University of Strathclyde - Department of Naval Architecture, Ocean and Marine Engineering

Qualification type: PhD

Location: Glasgow, UK

Funding for: Home-Scotland / EU / UK / International Students

Funding amount: The funding covers Home-Scotland / EU student tuition fees and stipend (~£15009 per year) in line with University rates (A student from the Rest of the UK (RUK) and an International Student may be considered for a partial grant).

Hours: Full Time

Start Date and Duration: October 2019, for 3 years.

Application closing date: 30 July 2019. Prompt application is advised, as this position is only available until a suitable candidate is found.

Project Title: Design Optimisation of Energy Saving Technologies for Energy Efficient Ships

Overview

Shipping has been, and still is, one of the most important methods of transport, with more reliance and importance now being placed on this mode of transport as a consequence of advances in shipping technology and the ability of ships to store and transport increasing capacities of goods. Although other forms of fuel power exist, such as wind energy and solar power, carbon-based fuel is currently the only way for ships to run effectively. For this reason, minimising fuel consumption is crucial for shipping companies. Such companies have therefore attempted to determine the optimum design, operation and maintenance approaches to increase the energy efficiency and to increase the profit of the company. The release of harmful gases due to the use of carbon-based fuel is another reason why shipping companies should aim to reduce the fuel consumption of their ships. Some regulations, such as the Energy Efficiency Design Index (EEDI) (IMO, 2014) and the Ship Energy Efficiency Management Plan (SEEMP) (IMO, 2012), and recommended practices such as the Energy Efficiency Operational Indicator (EEOI) (IMO, 2009a) have been implemented in recent times to limit the quantities of harmful gases that are released into the environment as a result of the fuel consumed by ships.

The importance of being energy efficient and the widespread understanding of the detrimental impact which carbon dioxide emissions have on the environment has been brought to prominence since the Kyoto Protocol treaty. The Kyoto Protocol, which was set up to try to reduce emissions of the six Greenhouse Gases (GHG), was negotiated in December 1997 in Japan, and legally ratified by the United Nations and entered into force on 16th February 2005. In this protocol, gas sources are categorised in different industrial sectors, one of which is transportation. Although shipping is marginally more environmentally friendly than other forms of transportation, such as aviation and land, it was reported that ships released 870 million tons of CO_2 in 2007 (IMO, 2009b). The International Maritime Organization (IMO) has therefore been forced, due in part to an increase in public awareness, to devise and implement energy efficiency and GHG regulations. Consequently, the marine industry needs to find solutions to reduce GHG and achieve more energy efficient shipping. There is a plethora of methods capable of making ships more energy efficient and reducing their CO_2 emissions. However, focusing specifically on ship voyage operations, ship maintenance and the **implementation of new technologies** have been highlighted as being the most effective ways of reducing CO_2 emissions and increasing energy efficiency. It is therefore important that the industry and academia investigate solutions for how to reduce fuel consumption and carbon gas emissions by implementing new technologies such as new **Energy Saving Devices (ESD)** and **Fouling Control Coatings (FCC)**.

Energy saving technologies provide an increase in ship performance, which leads to a reduction in fuel consumption and greenhouse gas (GHG) emissions. These technologies include Energy Saving Devices, ESDs (pre-swirl devices and post-swirl devices) and fouling control coatings, FCCs. Standard ESDs and FCCs on the market may be beneficial for some ships under certain circumstances, however, these technologies do not work efficiently for all ships since each ship has her own characteristic and operational profile. It is therefore critical to design and optimise tailored ESDs and select proper FCCs for individual ships based on their operational profile.

An ideal ESD should regulate the flow characteristics around the ship in question and ultimately decrease the required power for not only the design conditions but also the other operational conditions. Similarly, an ideal marine coating should be smooth enough to improve the surface properties of a hull in the as applied condition and should be effective against marine biofouling that occurs over time.

A major challenge is to relate these energy saving technologies such as Energy Saving Devices and fouling control coatings, and the effect of biofouling, to full-scale ship resistance and powering, in order to evaluate their effects on energy efficiency, fuel consumption and hence CO_2 emissions. While retrofitting existing ships with the existing ESDs and FCC may improve their energy efficiency, it is equally important to systematically model and predict the potential effects of these technologies and biofouling on ship resistance and powering and investigate the working mechanisms of such technologies and finally optimise them by performing scientific research. However, at present, no complete procedure exists to design and optimise energy saving technologies for different ship types for maximum performance. The main motivation and goal of this study are therefore to fill this gap by developing novel experimental and numerical methods to investigate these technologies and ultimately optimise them for specific ships.

The main aim of this PhD project is to develop procedures to design and optimise energy saving technologies for different ship types for maximum performance using Experimental and Computational Fluid Dynamics (EFD and CFD). The project will also be supported by the industry.

The candidate is expected to spending time at the Kelvin Hydrodynamics Laboratory to conduct experiments supporting his/her study.

Name of supervisor(s)

Dr Yigit Kemal Demirel

Dr Weichao Shi

Professor Mehmet Atlar

Eligibility Criteria

Applicants should have a distinction pass at Master's level in naval architecture/ocean engineering/mechanical engineering or a related subject, or first class BEng/BSc Honours degree, or equivalent, in naval architecture/ocean engineering/mechanical engineering or in a related subject. Applicants must be available to commence academic studies in the UK by October 2019.

Some experience of Computational Fluid Dynamics (CFD) (e.g. STAR-CCM+, OpenFOAM) would be an advantage but is not essential. The project requires a mixture of skills, including numerical and experimental fluid dynamics, ship hydrodynamics, computer programing and basic statistics.

How to apply

Applicants should send their application directly to Dr Yigit Kemal Demirel

e-mail: yigit.demirel@strath.ac.uk

Applications should include:

- Cover Letter
- CV with two references
- Degree transcripts and certificates and, if English is not your first language, a copy of your English language qualifications.

Contact

If you wish to discuss any details of the project informally, please contact Dr Yigit Kemal Demirel, e-mail: yigit.demirel@strath.ac.uk