PHD OFFER: INNOVATIVE CONTROL STRATEGIES OF PROPULSION SYSTEM FOR SHIPS IN WAVES

Location: LHEEA lab., Nantes, France

Director: Pr. Xavier Tauzia

Co-director: Dr. J. Thiaucourt + Pending (hydrodynamicist)

Industrial supervisor: Pending (MAN Energy Solutions France)

Contact details: Interested candidates should submit a cover letter of interest, curriculum vitae to xavier.tauzia@ec-nantes.f, jonas.thiaucourt@ec-nantes.fr

Subject

Waves cause periodic change in the propeller depth due to ship motions. This effect influences the propeller operating point (link between wave orbital motion, advance ratio and propeller load, torque, and efficiency). The engine performances and more largely the propulsion system are also impacted by transient loads.

As suggested by Taskar et al. (2015), the propulsion system performances in waves (engine and propeller) should be studied as a coupled system considering all the above-mentioned effects.

For marine engines, state-of-the-art is constant rpm control. However, regarding fuel consumption and engine aging this control strategy may not be the optimum strategy in waves (as suggested by preliminary studies).The current PhD position proposes to investigate innovative control strategies of the propulsion system of large ship under wave conditions. The innovative control strategies will be considered regarding various propulsion system architectures (electric or/and wind hybrid, variable pitch propeller...). This PhD study are important regarding industrial stakes toward

Since disparity between results are expected to be small, a strong focus is required on numerical uncertainties.

The main objectives are to:

- Develop and evaluate propulsion system control strategies for various architectures with respect to KPI (Key Performance Indicators) for ships in waves;
- Develop and evaluate new dimensioning approaches of propulsion systems based on the optimization of ship operation in real sea state. Depending on the results:
- Validate the new strategy with experimental tests.

Several test cases will be investigated, including:

- Various sea states, corresponding to a typical ship route
- Various types of ships and engines, possibly
- Various types of propulsive plants, including variable pitch propellers or hybridization

To do so, the PhD candidate will use an internally developed code coupling a hydrodynamic ship model and an engine model. To the best of the author's knowledge, this work would be a novel and original contribution regarding ship engine controllers.

Skills

- Simulation / coding
- Ocean Engineering knowledge
- Energy conversion / Internal Combustion Engines
- Systems control