Towards a ship manoeuvring model in shallow water waves

Tello Ruiz Manases[1], Thibaut van Zwijnsvoorde[1], Guillaume Delefortrie[2], and Marc Vantorre[1]

[1] Maritime Technology Division, Faculty of Engineering and Architecture, Technologiepark Zwijnaarde 904, B-9052 Gent, Belgium
E-mail: Manases.ruiz@Ugent.be

[2] Flanders Hydraulics Research, Berchemlei 115, B-2140 Antwerp, Belgium

Maritime transportation of goods at low costs promotes naval industry yielding a continuous growth of this economical sector. This continuous growth has consequently increased the number of goods handled by ports, as well as the requested ship's loading capacity by shipsowners. The new maritime requirements, however, introduce new challenges regarding ship safety because of the denser traffic at port access and channels and the new ship's dimensions such as the ultra large container ships (ULCS). Not only safety requirements are a main concern to the emergent maritime sector, recently, attention has been drawn regarding CO_2 emissions allowance. Aiming to reduce this, the International Maritime Organization (IMO) has been working on new regulations to control the shipping industry. These regulations are established following the mandate from the Kyoto protocol to reduce CO_2 emissions with at least 20% by 2020. Within these requirements, the Marine Environment Protection Committee (MEPC) has developed an Energy Efficient Design Index (EEDI) to establish a power limit on-board.

The new challenges require a more realistic analysis of the ship dynamics, which implies the incorporation of vertical motions and, in a more general description, the incorporation of wave-induced-motions and wave forces into the manoeuvring problem. Waves are environmental effects commonly neglected in manoeuvring analyses, however, due to the new developments in the shipping industry their effects into ship manoeuvring cannot be longer neglected.

The present study discusses the wave effects and their impact into manoeuvring performance for shallow water scenarios. The study is based on experimental work conducted at Flanders Hydraulics Research (in cooperation with Ghent University under the European research program Energy Efficient Safe Ship Operation, SHOPERA, 2014) . The study comprises a systematic series of captive model tests with a VLCC-type tanker of 1/75 scale model (a ship developed by the Korean Institute of Ship and Ocean Engineering for testing and benchmarking, SHOPERA, 2014), here referred to as KVLCC2. The KVLCC2 tests were carried out in calm water, and in regular waves with different combinations of wave amplitudes and periods, ship speeds and wave angle of encounter.

References

SHOPERA. 2014. Energy Efficient Safe Ship Operation. Retrieved from http://www.shopera.org