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Simulating motions of an LNG bunkering vessel

MARIN recently carried out studies to investigate the motions of an LNG bunkering vessel with low GM.

To supply the increasing number of LNG-fuelled ships, more and more LNG bunkering vessels (LNGBV) are coming into service. Due to the light cargo a large part of the tanks is above the waterline, while at the same time, the draught is relatively small.

In combination with the weight of the bunkering equipment, the GM of LNGBVs can be low, leading to bigger roll motions. The LNGBV in the study will operate inside a port and in its sheltered anchorages but may in the future also need to transit to other areas.

In the first phase of the investigation, seakeeping calculations were carried out using our eXtendable Modelling Framework XMF to simulate the behaviour in extreme transit conditions. The SEACAL frequency domain model was used to calculate the wave response at different speeds, while MARIN's CFD solver ReFRESCO calculated the roll damping due to the skeg, ventral fins and the bilge keels.

In the second phase, operational conditions were studied. Two captains carried out manoeuvres on MARIN's Full-mission Bridge.

For these simulations the expected port of operation was modelled and the XMF model was further extended with visuals and parameters for actively steering the ship using its azimuthing propulsion and bow thruster. Simulator runs were carried out to assess the operational limits for berthing at the loading terminal and alongside vessels for bunkering. Runs were also executed to determine the expected heel and roll when sailing in beam wind and waves and in a turn. Even sailing with fenders alongside, hoisting fenders and hoisting fenders when sailing in a turn were simulated. Roll angles appeared to be relatively large, but not alarmingly so.

The motions and the forces in mooring lines and fenders during bunkering operations were assessed using time-domain calculations with aNySIM for the LNGBV moored alongside a large vessel at anchor. Calculations carried out for a 5-year hindcast of metocean conditions at one of the anchorages showed that the expected downtime for bunkering operations was insignificant. And the forces due to passing ships do not lead to problems for the moored LNGBV. ▬

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