

Application of Ship Dynamics for Manoeuvring Prediction to Assist Nautical Officers

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Abstract

Modern ship bridges are highly-automated man-machine systems. With the enlarged number of systems and sensors onboard, the increase of automation components and displays on the bridge is associated. Investigations are ongoing to integrate features for new manoeuvring and steering equipment such as azimuth propeller or waterjet as well as to enhance the predictions of own ship motions taking into account the use of the controls in time.

Prediction tools are very helpful and already in use on ships for a long time, beginning with trail modes in ARPA radars up to curved headline overlay in ECDIS. However, the simplification of these predictions allows restricted use only based either on estimated future courses & tracks or on the simple integration of the current ship motion not including the immediate response on changes of rudder and engine.

New concepts for on board displays and simulation tools were developed at the Institute of Ships Theory & simulation of Maritime Systems/ISSISMS and the Maritime Simulation Centre Warnemunde MSCW in research projects funded by the German Federal Ministry of Education and Research together with partners from bridge system manufacturers.

A prediction tool was developed to simulate the ships motion with complex dynamic models in fast time and to display the ships track immediately for the intended or actual rudder or engine manoeuvre. These simulations are based on input from the ships actual sensors via the Voyage Data Recorder and furthermore from diagnosis tools analysing the status of the manoeuvring facilities and providing information in case of failures, e.g. reduced engine power or larger rudder response time due to malfunctions of the equipment.

Within this paper investigations into the feasibility and user acceptance of the new layout of navigation display will be introduced and selected results of simulation studies testing the influence on manoeuvre performance dependent on different kind of prediction functions will be discussed. This Dynamic Prediction Display is intended be used on board of real ships but is also a effective tool for training in shiphandling simulators because the trainee can immediately see the result of the actual rudder, engine or thruster commands, even before the ship has changed her motion. Examples will be given for results from test trails in the full mission ship handling simulator of the Maritime Simulation Centre Warnemunde.

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