

ON THE COMPARATIVE SEAKEEPING ANALYSIS IN IRREGULAR WAVES OF COMMERCIAL SHIPS HAVING SAME DISPLACEMENT, FOR NAVIGATION SAFETY ASSESSMENT

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Abstract

For the shipping companies one of the operational safety criteria of their fleet is based on irregular waves seakeeping assessment. This study is focused on the comparative seakeeping analysis of two container ships, having in common only a same displacement 18000 t, with overall lengths of 139,96m and 149,50 m. The seakeeping analysis is based on the linear strip theory with frequency domain solution for the response transfer functions calculation on coupled heave - pitch and uncoupled roll motions. There is considered a full range 0-360 deg. heading angle and several ship speeds 0-20 knots. The short term irregular waves seakeeping analyses are carried out for ITTC, ISSC, JONSWAP and Pierson-Moskowitz reference wave power density spectra. The numerical analyses are carried out with own DYN_OSC program. The operational safety seakeeping criteria are expressed as limit RMS root mean square values for heave, pitch, roll motion and acceleration amplitudes, specific for commercial maritime ships. Based on the resulting statistical short term dynamic response polar diagrams, on each motion component and cumulative, this study is pointing out the influence of ship dimensions, speed and heading angle on the navigation safety assessment.

Keywords: seakeeping analysis, operational safety criteria, irregular waves

1. INTRODUCTION

The navigation safety assessment in irregular waves represent a mandatory analysis carried out for maritime ships [8],[9], taking into account the environmental conditions and seakeeping criteria restrictions [5],[6]. Other parameters that have to be considered at seakeeping analysis are the ship speed, heading angle and loading conditions.

The seakeeping analysis involves the following steps: computation of amplitude transfer functions on ship hull oscillation degrees of freedom, short term power density wave spectrum selection according to the environmental conditions, seakeeping limit criteria selection according to the ship type and finally ship navigation safety assessment [1],[2],[4],[11]. This study involves deterministic analysis for oscillations amplitude transfer function computation on regular waves and statistical short term analysis on irregular waves for significant wave spectra of the sea selected operation area.

This study includes the seakeeping linear analysis, coupled heave and pitch oscillations, uncoupled roll oscillations, for two container ships of 800 TEU and 1300 TEU, with different main dimensions and having selected full or intermediate loading conditions, corresponding to the same displacement of 18000 t. The irregular waves are considered for several wave significant height $H_{s,0}$ and four short term wave spectra, ISSC, ITTC, Pierson - Moskowitz and JONSWAP [1],[2],[7],[8],[9].

The seakeeping analysis polar diagrams are obtained for a full range 0 to 360 deg. heading angle, ship speed range 0 to 20 knots and maximum wave significant height of 12 m.

The main objective of the present work is to point out the influence of ship dimensions, speed and heading angle on the navigation safety assessment.

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