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Hydro Structure Interactions in Seakeeping

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Abstract. Even without considering the ship's structural responses, the numerical modeling of the ship seakeeping behavior remains an open problem for a general case of the ship advancing in waves with arbitrary forward speed. This is true both for, the most commonly used, potential flow models and for the general CFD codes based on solving the Euler and/or Navier Stokes equations. The main problems of the modeling concern the correct representation of the waves generated by the interaction of the ship with the sea waves, and the presence of the free surface which is not only unknown in advance but, at the same time, supports a highly non-linear boundary condition. The impossibility to solve the complete non-linear seakeeping problem at once, led to the different levels of simplification of the original non-linear boundary value problem. The common practice consists in identifying the most dominant physical aspects, of the particular problem, and in application of the dedicated simplified numerical models free of the "non-important" parts.

Only the potential flow models for fluid flow are considered in this paper and the main aspect is put on hydro-structural coupling issues and corresponding structural responses. In that respect and for some parts of the analyses, the hydrodynamic part is supposed to be known i.e. it is assumed that the boundary value problem for the velocity potential was efficiently solved. Both local and global hydro-structural issues are considered and that in the context of the ultra large ships (LNG carriers and container vessels) for which the common rules of classification societies reach their limits and direct calculation procedures are necessary.

Key words: *Hydro-structure interactions, Potential flow, Quasi static loads, Hydro-elastic interactions, Impact loads.*

1. Introduction

It is enough to take a look on Figure 1., to understand how difficult the numerical modelling should be for general seakeeping problem. Indeed, lot of different physical phenomena are involved (waves, ship speed, large ship oscillations, slamming, sprays, wind, ...) and it is impossible to take all them into account at once. It is fair to say that, up to now, there is no efficient numerical tool for global modeling of these kind of situations with sufficient accuracy. That

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