Predicting the effect of barnacle fouling on ship resistance and powering using CFD

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To reduce the fuel consumption and green-house gas emissions of ships, understanding ship resistance is important. In this context, understanding the effect of surface roughness on the frictional resistance is of particular importance since the skin friction, which often takes a large portion in ship drag, increases with surface roughness.

In this study, a Computational Fluid Dynamics (CFD) model was developed to predict the effect of barnacle fouling on ship resistance and effective power of the full-scale KRISO container ship (KCS) hull. A roughness function model was employed in the wall-function of the CFD software to represent the different barnacle fouling conditions, and the simulations of flat plate representing KCS and 3D KCS hull were conducted at the design speed and a slow streaming speed to predict the roughness effect of different fouling conditions on the ship resistance and the effective power. The resulting changes in the frictional resistance, residuary resistance and effective power due to different fouling conditions were compared with each other. Finally the frictional resistance values obtained by CFD and the similarity law analysis were compared.

Numerical simulation of progressive flooding of a ship after damage

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The survivability of a ship, in case of flooding following damage, is a quest which occupies the maritime community for more than one century now. The flux of flood water in ship's complex internal compartmentation is influenced by various factors and has a substantial impact on ship motion. Scientists and engineers, trying to understand and to take practical decisions during the design process, have developed simplified models with questionable assumptions and simplifications of this complex hydrodynamic problem. One commonly used approach for the evaluation of the survivability performance of a vessel against damage is the hydraulic analysis of the water inflow and propagation. This research investigates the flooding of the ITTC benchmark model, a box shape barge with a simplified internal geometry. For the numerical simulations are used a commercial high fidelity computational fluid dynamics tool and a simplified hydraulic model. The aim of this work is the understanding of the flooding process and the ensuing flooding moments, as well as the qualification and quantification of the impact of the various physical assumptions that the existing models incorporate. The parameters under investigation are the size of the damage, air compressibility, flow characteristics and internal arrangement.