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Numerical simulation for the rudder in order to control the cavitation phenomena

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Abstract

In these ten years, the cavitation and erosion phenomena in the rudder have been increased for high-speed container ships. The cavitation in the rudder blades which is injurious to rudder efficiency is mainly caused by the main flow with a large angle of attack induced by propellers, and the erosion which occurs as a result of repeated blows by shock wave that cavitation collapse may produce was observed in the gap region of the rudder. However, gap cavitation is not prone to occur in model experiments because of low Reynolds number. So, the viscous effect should be considered for solving the flow of the narrow gap. In order to predict the cavitation phenomena and to improve the performance of the rudder, the analysis of the viscous flow in the rudder gap is positively necessary.

In this study, numerical calculation for the solution of the RANS equation is applied to the two-dimensional flow around the rudder gap including horn part and pintle part. The velocity and pressure field are numerically acquired according to Reynolds number and the case that the round bar is installed in the gap is analyzed. For reduced the acceleration force when fluid flow through the gap, modified rudder shape is proposed, It is shown that pressure drop can be highly restrained numerically and in model experiment, the cavitation bubbles can be reduced.