Level-set Simulation of Viscous Free Surface Flows around Commercial Ships

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Abstract

The viscous free surface flows around KRISO container ship(KCS) and US navy combatant, DTMB5415 are computed by solving the Reynold-Averaged Navier-Stokes equations with a finite volume method. The free surface is captured with the Level-set method and the realizable k-ε model is employed for turbulence closure. To create the grid system, hull surface meshes are generated starting from IGES form of NURBS surface data. Taking the generated surface mesh as a boundary grid surface, three-dimensional multi-block field grids are obtained using GRIDGEN package. The computations are carried out at model scale. The present numerical results will be compared with experimental results of KCS from KRISO model test in Korea and DTMB5415 from INSEAN model test in Italy.

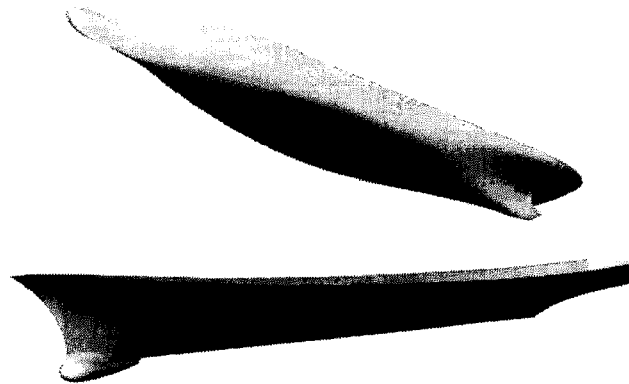The following figures are parts of the present full paper.

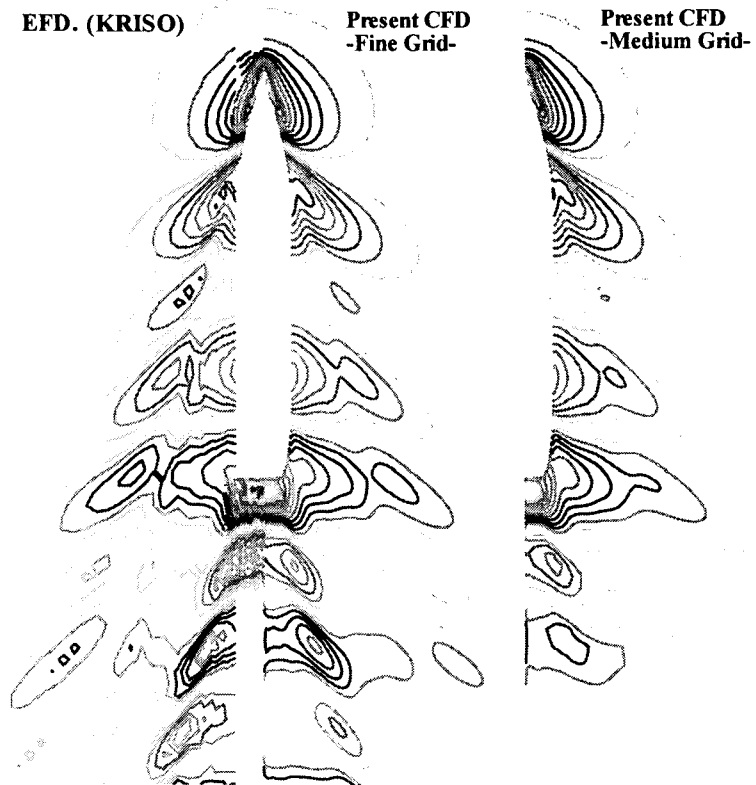Fig.2 Overall view of KRISO container ship &DTMB5415 combatant ship

EFD. (KRISO) Present CFD -Fine Grid- Present CFD -Medium Grid-

Fig. 2 Comparison of Wave Patterns with Experimental results
(KRISO container ship, Re=4x10^6, Fn=0.26)

EFD. (KRISO) Level-Set Method EFD. (KRISO) Level-Set Method
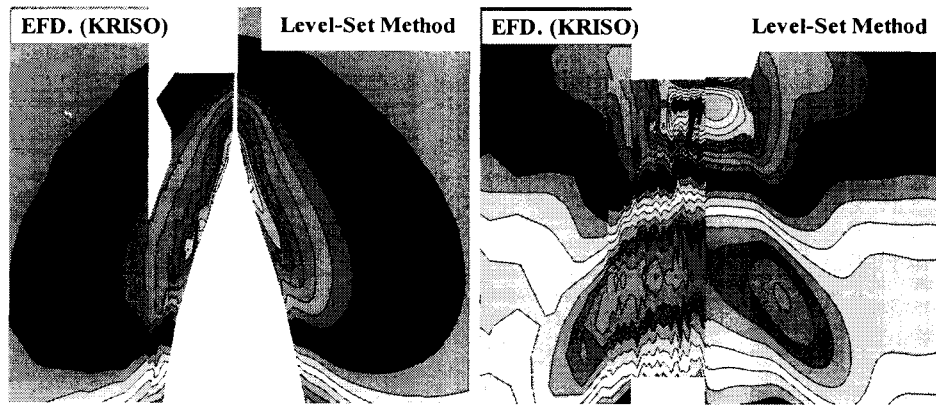
Fig. 3 Comparison of Bow and Stern Wave Patterns
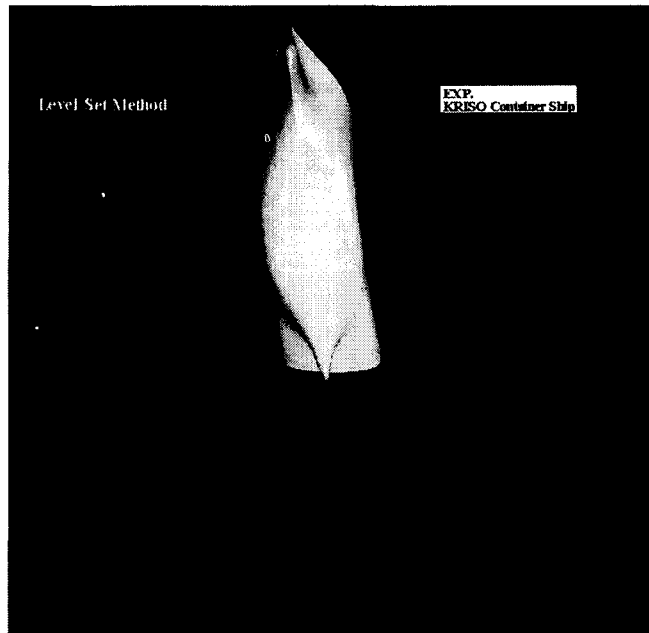(KRISO container ship, Re=4x10^6, Fn=0.26)

Fig. 3 Overall view of Simulated Wave Patterns compared with Experimental result.
(KRISO container ship, Re=4x10^6, Fn=0.26)

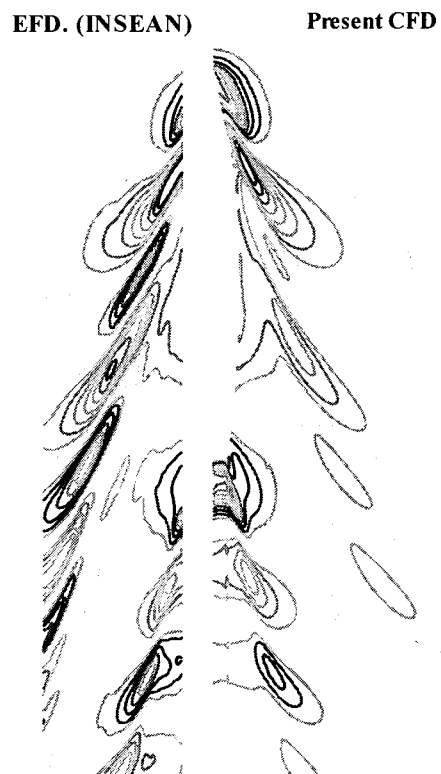Fig. 4 Comparison of Wave Patterns with Experimental results
(DTMB5415, Re=1.26x10^7, Fn=0.28)