Using SC/Tetra to Estimate Ship Hull Pressure Fluctuation

Case study for cavitation flow analysis

SC/Tetra is used to simulate transient cavitation around a ship propeller and estimate the resultant ship hull pressure fluctuation

Estimating Ship Hull Pressure Fluctuation

Transient cavitation around a ship propeller is caused by non-uniform flow in the wake of the ship body. Because this results in increased ship vibration, noise, and erosion, predicting cavitation during the ship design phase is essential.

Referencing cavitation flow test conditions for a ship model[1], SC/Tetra was used to evaluate propeller transient cavitation and verify the accuracy of computationally estimating the resultant ship hull pressure fluctuation[2].

Ship body and propeller geometry – analysis overview
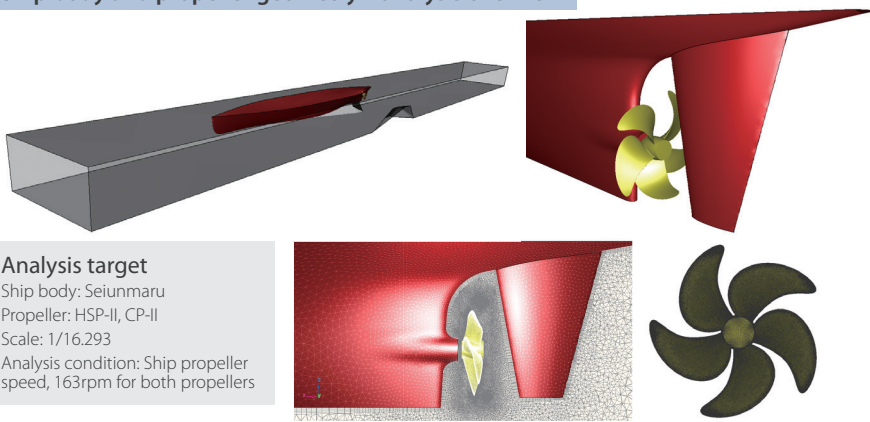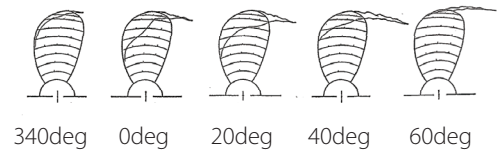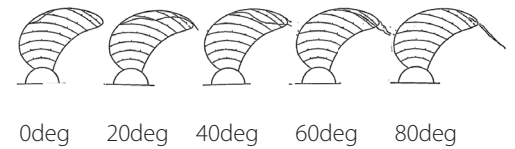

Analysis target
Ship body: Seiunmaru
Propeller: HSP-II, CP-II
Scale: 1/16.293
Analysis condition: Ship propeller speed, 163rpm for both propellers
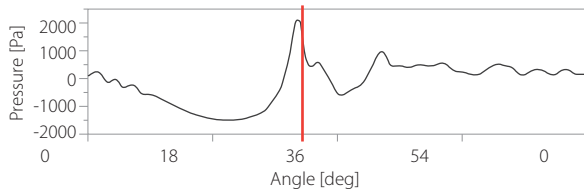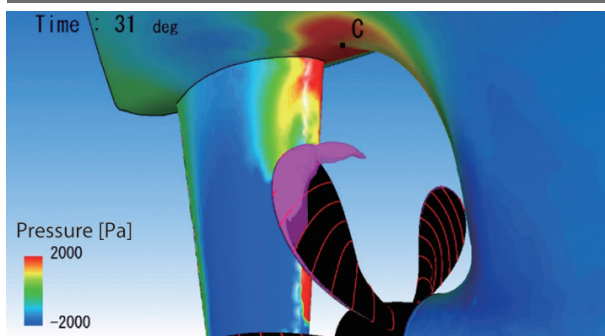
[1]Kurobe, Y., et al., "Measurement of Cavity Volume and Pressure Fluctuation on a Model of the Training Ship" 'SEIUNMARU' with Reference to Full Scale Measurement (in Japanese)″ , SRI Report, 1983
[2]Fujiyama, K., "Investigation of Ship Hull Pressure Fluctuation induced by Cavitation on Propeller using Computational Fluid Dynamics", Proc. of the 17th Cavitation Symposium, 2014

Comparison of cavitation patterns
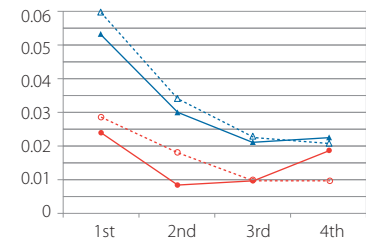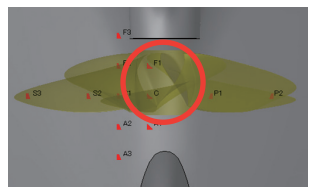
CP-II 163rpm condition

340deg   0deg   20deg   40deg   60deg

HSP-II 163rpm condition

0deg   20deg   40deg   60deg   80deg

Analysis of pressure fluctuation

Pressure [Pa]
2000
−2000

Comparison of pressure amplitude fluctuation between analysis and experiment

Primary blade passing frequency component
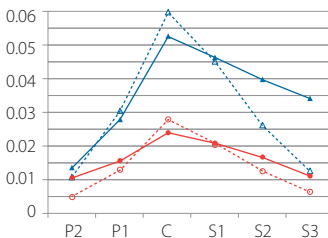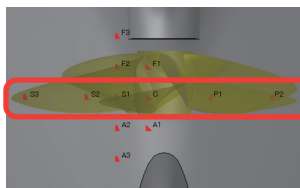
Amplitude of pressure fluctuation*

* directly above propeller

HSP — CP
HSP Exp ---- CP EXp

Notes

SC/Tetra was used to predict transient cavitation around a ship propeller and the subsequent induced pressure fluctuation on the ship hull with high accuracy. With this confidence, these analyses can be performed during the design phase for new ships to optimize ship body and propeller geometries.