

CFD Application of Simplified Propeller Model to Simulate Propeller/Rudder Interactions

Case Study of SC/Tetra

SC/Tetra and infinitely bladed propeller theory are used to analyze propeller and rudder performance

Propeller-Rudder Interaction

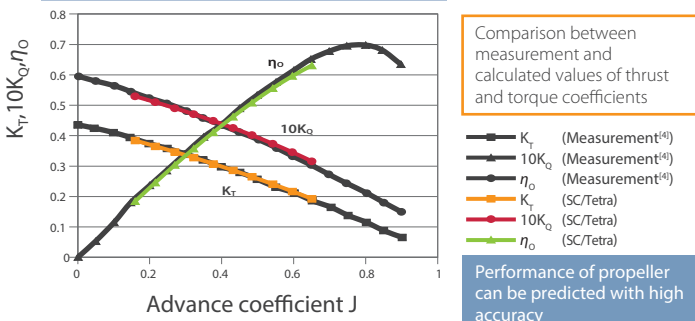
Interactions between the hull, propeller and rudder are critical considerations when examining the propulsion performance of a vessel. Analysis methods that rotate a realistically shaped propeller are becoming more practical. However, a high calculation load is still the main bottleneck.

To address this, a simplified model based on the infinitely bladed propeller theory [1-3] was used with SC/Tetra. This propeller model has been verified in a variety of applications and reduces the calculation load. In this case study, the simplified propeller model was used to simulate the performance of a propeller and the associated propeller-rudder interactions. Analysis results were compared with test measurements.

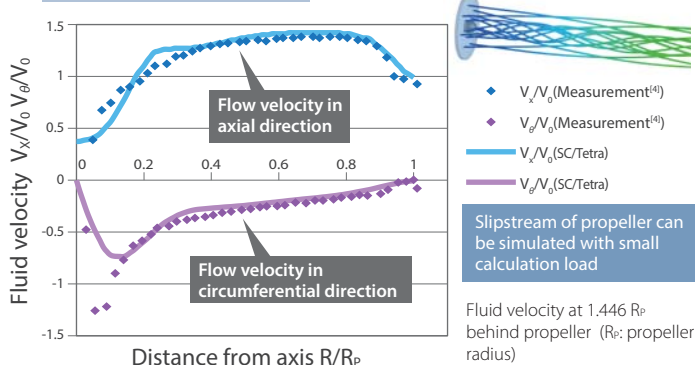
- [1] Kuniharu Nakatake. 1967. Report of the West-Japan Society of Naval Architects, 34th volume: p25-36
- [2] Fumio Moriyama. 1979. Report of the Japan Ship Technology Research Association. 16th volume, 6th issue: p361-376
- [3] Takero Tamada, Jun Ando. 2015. Conference book of the Japan Society of Naval Architects and Ocean Engineers. 21st issue: p555-558

Infinitely bladed propeller theory

Individual performance of propeller

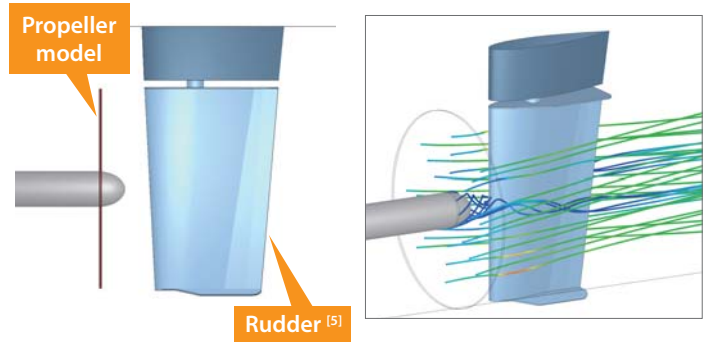


Slipstream of propeller



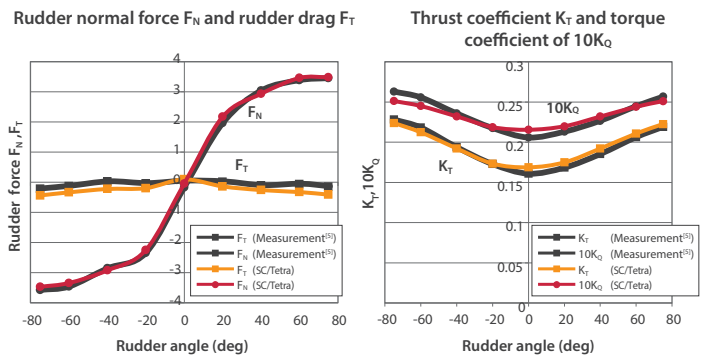
- [4] Kazuyuki Ouchi, Masahiro Tamashima, Toshio Kawasaki, Koizuka Hajime. 1989. Journal of the Society of Naval Architects of Japan. 165th issue: pp.43-53

Analyzing propeller-rudder interaction



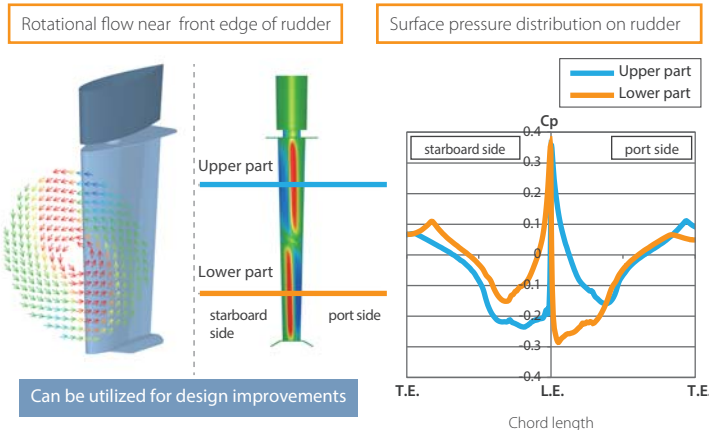
Comparison between analysis and test results

Performance of propeller and rudder during interaction



- [5] Yukio Tomita, Takayuki Wakabayashi. 2001. Fune no kagaku. 54th volume: p58-61

Rotational flow near front edge of rudder and surface pressure distribution



Notes

Propeller-rudder interactions were analyzed with a low calculation load by applying the infinitely bladed propeller theory to SC/Tetra. Analysis results closely agreed with measurements. The next step is to include the interactions with the hull. This will establish the simplified propeller model as a valuable tool for accurately estimating vessel propulsion performance using SC/Tetra.