A Study on Seven-bladed Propeller for High-speed Ships by CFD

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ABSTRACT

Japan's National Maritime Research Institute (referred to as NMRI) et al. developed propeller design charts for determining propeller particulars, known as the MAU series, which are frequently used for commercial ships. Figures 1 and 2 show the MAU series propeller profile and design chart. Subsequently, advanced propeller design charts based on the MAU series were developed by model tests and CFD using innovative propellers, emphasizing blade section, propeller profile, blade area, etc. Yamasaki *et al.* (2013), for instance, developed propellers with minimized blade area (Fig. 3) and Okazaki *et al.* (2019) developed propellers with backward tip rake (Fig. 4). Designing propellers with design charts will have a maximum blade count of 6 blades, due to the unavailability of design charts for 7-bladed propellers. However, a 7-bladed propeller might be advantageous when the propeller diameter is severely constrained, such as on a roll-on/roll-off ship (referred to as ro-ro ship). In this research, the authors developed 7-bladed propeller design charts by conducting model experiments, which were then used to design the propellers for high-speed merchant vessels. CFD calculations were carried out to compare the performance of the propellers with different numbers of blades, and it was found that the 7-bladed propeller was superior in terms of efficiency, cavitation performance, and risk of hull vibration when there is a substantial limitation on the propeller diameter.

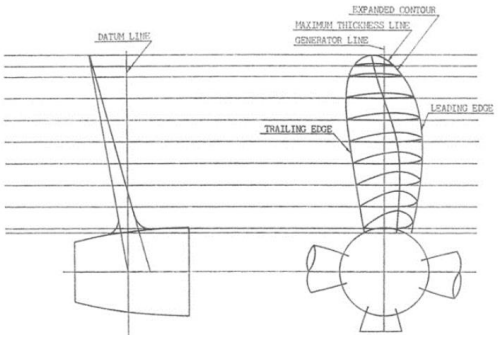

Figure 1. MAU series propeller

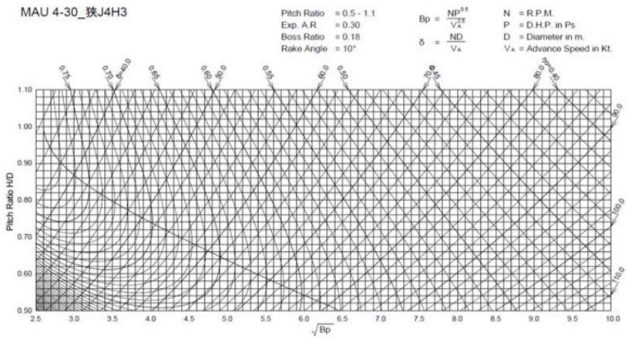

Figure 2. Propeller Design chart of MAU series

Figure 3. Smallest blade area propeller(right side)

Figure 4. Backward tip rake propeller