Aspects of Propeller Development for a Submarine

Design and development of propellers for submarines are in some ways different from propellers for surface vessels. The most important demand is low acoustic signature that has priority over propeller efficiency, and the submarine propeller must be optimized with respect to acoustics rather than efficiency. Moreover, the operating conditions of a submarine propeller are quite different. These aspects are discussed as well as the weighing of the various propeller parameters against the design objectives. The noise generated by the propeller can be characterized as thrust noise due to the inhomogeneous wake field of the submarine, trailing-edge noise and noise caused by turbulence in the inflow. The items discussed are demonstrated in a case study where a propeller of the Kappel type was developed. Three stages of the development are presented, including a design of an 8-bladed propeller where the thrust fluctuations as well as the thrust noise were significantly reduced relative to a 7-bladed propeller. Results of measurements are in good agreement with calculations.