Scour Problem Caused By Twin Propeller Jet Flow

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Abstract:

Maritime transport accounts for the majority of global trade worldwide. Advancements in marine engineering have led to the development of increasingly powerful and efficient propulsion systems. Among these, twin propeller configurations play a significant role in enhancing vessel maneuverability and operational performance. However, the high-velocity jet flows and complex turbulence generated by twin propellers near the seabed can induce significant local scour around berthing structures.

This study focuses on the investigation of scour mechanisms generated by twin Wageningen B-series propellers. Experimental tests were conducted in a flume located at the Istanbul Technical University Hydraulics Laboratory. The flume has dimensions of 6.2 m in length, 1.52 m in width, and 1.2 m in depth. A sand bed with a median grain size of d50=0.35 mm was prepared, with dimensions of 0.30 m in depth, 2.0 m in length, and 1.5 m in width. The spacing between the propellers was maintained at 1.5 times the propeller diameter (1.5Dp). Twin propellers, each with a diameter of 10 cm, were installed on adjustable platforms to investigate propeller gaps (G) of 10 cm and 15 cm under rotational speeds of 590 rpm and 790 rpm.

The results indicate that scour profiles are strongly influenced by the ratio of propeller gap to diameter (G/Dp) and the densimetric Froude number. Furthermore, the findings demonstrate that propeller rotational speed, in combination with propeller spacing, significantly affects both the morphology and the extent of the resulting scour patterns.