



THE INVESTIGATION INTO RESISTANCE AND FLOW CHARACTERISTICS AROUND UNDERWATER BODIES OPERATING NEAR FREE SURFACE

S. Srinakaew¹, P. Kanyoo² and S. Chandrababha²

¹ Department of Marine Engineering, Royal Thai Naval Academy, 204 Sukhumvit Road, Paknam, SamutPrakan, Thailand, 10270

² Royal Thai Navy Midget Submarine Research Project, Naval Research and Development Office,
Royal Thai Navy, 83 moo 12 SalaThammasop, ThawiWatthana, Bangkok 10170

Abstract

The coastlines of Thai territories are approximately over 1,500 miles which are required the routine and special patrol operations to protect the national oceanic resources and treasures. The collaboration of surface, air and underwater operations is the main responsibility for Royal Thai Navy and associated affiliations. Usually, underwater operation requires the submarine with different capabilities. As the main roles of the submarine are different depending on the user requirements and design. The small submarine or Midget Submarine normally has different capabilities and mission envelopes which are normally close to the coastline and shallow water compared with the bigger submarines. Analysis of the submarine hydrodynamic characteristics with the effects of the free surface as the near surface operation is one of the aspects that need to be investigated. Resistance and wave elevation are the main aspects that are more concerned to ensure that the submarine can operate with the desire speed and avoid the wave effects. To demonstrate those characteristics, four different underwater platforms including spherical model, teardrop, torpedo and submarine are investigated. As the advancement of the computer, Computational Fluid Dynamic (CFD) code, STAR CCM+, with the Reynolds-Averaged Navier-Stokes equations (RANS) is used as a tool to assess the underwater platform performance. The resistance coefficients are performed on the speeds of 0.325, 0.651, 1.301, 1.952 and 2.440 m/s which are corresponding to operating speed of 2, 4, 8, 12 and 15 knots respectively for the 30-meter Midget Submarine. Wave elevation is measured to calculate wave resistance to demonstrate the critical speed that generates wave and cause the increase of resistance.

Keywords: Computational Fluid Dynamics (CFD), Free surface effects, Midget Submarine, Wave resistance