Abstract

This work deals with the design, manufacturing and sea trials of a prototype of novel marine propulsion system based on the principles of ramjet propulsion. The marine ramjet is based on usage of water itself as the primary working fluid in the thrust creation process. Accelerating the working fluid is done by adding gaseous phase in the form of bubbles into the aqueous medium, thus creating a two-phase mixture of water and air, expanding through a nozzle and generating thrust. Adding the gaseous phase into the liquid significantly changes the physical characteristics of the medium, eg, introducing compressibility and substantially reducing the speed of sound. The research is motivated by the advantages of the proposed propulsion system over the conventional propellers, particularly at the high speed range, over 30 – 40 knots (15 – 20 m/s), where propellers are inefficient. Open sea trials have been conducted using an experimental boat having two ramjet propulsion units and equipped with a turbo-compressor for air supply. The measurements included: boat velocity, air flow into the underwater units, pressure distribution along the underwater units and vessel drag (resistance) – enabling thrust and propulsion efficiency calculations. The sea trial results reveal good agreement with the theory, indicating a real potential for ramjet based marine propulsion.