Stepped Cambered Planing Hull with Hydrofoils
Technology #18247

Applications

The inventors have developed a Stepped Cambered Planing Hull (SCPH) with drastically reduced drag and motions in waves for application to high speed crafts.

Problem Addressed

With emerging applications for high speed boats in commercial, military and off shore industries, there is a focus in the naval architecture community to improve the efficiency and performance characteristics of planing hulls at high speeds. The Inventors have optimized the shape of the planing surface to reduce wetted surfaces while increasing lift created mostly by camber as opposed to angle of attack, thus dramatically reducing the total resistance of the planning hull for improved boat speed. Moreover, the combination of two dynamic forces applied (in the cambered planing surface and on the surface piercing hydrofoil) applied at relatively fixed points, as opposed to a single force moving along the bottom of a traditional planing hull pitching in waves, drastically reduces the motion response of the whole planing craft.

Technology

Conventional vehicle hulls experience lift primarily due to angle of attack of the flow with respect to the bottom surface and their dynamic attitude vis-a-vis their running trim angle. In the SCPH configuration, the majority of lift is provided by a swept back cambered surface, while the remainder of the lift is produced by the hydrofoil which also provides trim control and stability. The afterbody is fully ventilated by use of a V-shaped step positioned at the trailing edge of the cambered surface on the bottom and has an unconventional W-shape which reduces the impact of slamming.

The Inventors have developed a method to optimize the non-uniform distribution of camber (curvature) and the along the breadth of swept planing surface to obtain the requested lift with the lowest drag at design speed. The Inventors observed that as speed decreases, the hull has to recover hydrodynamic force by increasing its trim. Therefore, they increase the lift on the forebody by lowering the interceptor blade below the step edge. The action of the interceptor is to create a region with higher pressure distribution upstream of the interceptor, thus developing hydrodynamic lift. Finally, the stern hydrofoil is surface piercing to provide self-pitch stabilization to the hull; more area of the hydrofoil is submerged for a pitch-by-stern rotation and it automatically creates a restoring pitch moment. The design of the surface piercing hydrofoil is also optimized for stable and safe operation at high speed, using a patented hydrofoil section that guarantees high efficiency and stable ventilation.

This project was sponsored by ONR with Dr. Stefano Brizzolara at Virgina Tech as PI.

Advantages

- Hull resistance reduced by as much as 30% when using this design; an outstanding result in
naval architecture where usually few percent drag reduction count.

- Hydrofoil ensures no drastic loss of lift due to the ventilation onset and minimum drag also in fully wet conditions

**Categories For This Invention:**

Transportation
Other (Transportation)

**Intellectual Property:**

Stepped cambered planing hull
Issued US Patent

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**External Links:**

SCPH Video
https://www.dropbox.com/s/sdbt1djheqdc2uj/SCPH2_Fn5-5.mp4

**Image Gallery:**

![Image of a boat](image-url)