

Design concepts of high-speed vessels (hydroplanes, hydrofoil boats, hovercrafts and airfoil boats)

Hydroplane boats

1. General information of hydroplanes

- 1.1. Hydrodynamic mode of motion and shape of hydroplane
- 1.2. Classification of hydroplanes and their design - layout features

2. Hydrodynamics and seaworthiness of hydroplanes

- 2.1. Distribution of velocities and pressures in the flow of water under hydroplane surface
- 2.2. Hydrodynamic lift and drag forces
- 2.3. Dimensionless hydrodynamic characteristics
- 2.4. Calculation of hydroplanes hydrodynamic characteristics
- 2.5. Seaworthiness of hydroplane boats

3. Project development of hydroplane boat at the initial stage

- 3.1. Determination of the load of hydroplane boat
- 3.2. Balance of hydroplane boat
- 3.3. Determination of proportions and main dimensions of hydroplane boat
- 3.4. Approximate determination of the attainable speed of hydroplane boat and required power propulsion

4. Design elements of the hull form of hydroplane boat

- 4.1. Un-stepped hard chine shape of hydroplane boat
- 4.2. Stepped hull shape of hydroplane boat
- 4.3. Stepped hull shape of hydroplane boat like «deep V»
- 4.4. Tendencies of modern development of hydroplane boats shapes

Hydrofoil boats

5. Hydrofoils and hydrofoil systems

- 5.1. Geometric characteristics of hydrofoils
- 5.2. Hydrodynamic characteristics of hydrofoils
- 5.3. Constructive types of hydrofoils and their seaworthy features: shallow-submerged hydrofoils, semi-submerged hydrofoils, stackable hydrofoils, controllable hydrofoils
- 5.4. Hydrofoil systems

6. Development of hydrofoil boats

- 6.1. Initial period of development of hydrofoil boats
- 6.2. Development of hydrofoil boats after World War II
- 6.3. Overview of the modern hydrofoil boats

7. Seaworthiness of hydrofoil boats

- 7.1. Starting the hydrofoil mode and water resistance of hydrofoil boat movement
- 7.2. Static and dynamic stability of hydrofoil boat
- 7.3. Navigation of hydrofoil boat in sea swell

8. Project development of hydrofoil boat in the initial stage

- 8.1. Features and a sequence of project development of hydrofoil boat
- 8.2. Determining the basic characteristics of hydrofoil boat as a first approximation
- 8.3. Refinement of the design characteristics of hydrofoil boat in the second approximation: determination of hydrofoil boat mass; structure - layout development of passenger hydrofoil boat

- 8.4. The choice of elements of the complex hydrodynamic «hydrofoil – vessel hull»: hydrofoil device and its particulars; square and dimensions of hydrofoils; location of hydrofoils along the vessel; profile selection of hydrofoils; refinement of hydrofoils lift force; height and profile of hydrofoils supports; starting device; vessel hull shape

Hovercrafts (air-supported)

9. General information about hovercrafts

- 9.1. The development of hovercrafts
- 9.2. Classification of hovercrafts
- 9.3. Flexible sealing (skirt) of air-cushion. Materials for flexible skirts
- 9.4. Structural and layout features of hovercrafts: amphibious hovercrafts; side-wall vehicles; semi- amphibious hovercrafts
- 9.5. Applicable engines, propellers and fans for hovercrafts

10. The core of hydro- aerodynamics of hovercrafts

- 10.1. Static of hovercrafts: the main characteristics of the lift, the static stability
- 10.2. Resistance to the hovercrafts movement: resistance to the hovercrafts amphibious; resistance to the hovercrafts side-wall

11. Design of hovercrafts

- 11.1. Design of hovercrafts amphibious: project characteristics and their interdependences for hovercrafts amphibious; determination of mass and particulars of hovercraft in first approximation; determination of the characteristics in second approximation
- 11.2. Design of hovercrafts side-wall: project characteristics and their interdependences for hovercrafts side-wall; determination of mass and particulars in first approximation; determination of the characteristics in second approximation

Cover of airfoil boats design concepts

12. General information about airfoil boats: boat or aircraft; airfoil boats amphibious and boats with aerodynamic unloading

- 12.1. The use of seabirds of surface effect (information from the bionics)
- 12.2. History of development and review of airfoil boats designs; airfoil boats starting projects; development of structures of airfoil boats after World War II; passenger airfoil boats
- 12.3. The airfoil boats of military purpose and their projects: airfoil boats and attack aircraft carrying; airfoil boats anti-submarine; airfoil boats patrol; airfoil landing boats and amphibious military - transport

13. Features of surface-effect flight aerodynamics

- 13.1. The surface-effect flight aerodynamics of power-actuated foil
- 13.2. The problems of stability of surface-effect flight
- 13.3. The methods of experimental study of wing surface-effect flight

14. Seaworthiness and features of the design of airfoil boats

- 14.1. Structural materials and design features of airfoil boats
- 14.2. Propulsive property and seaworthiness of airfoil boats
- 14.3. Controllability and stability of airfoil boats
- 14.4. Features of airfoil boats design