Propulsion of ships and maneuverability

1. General characteristics of vessel propulsion

1.1. Structural types of propulsion system for ships
1.2. The efficiency of the propulsion system as a tool of vessel control
1.3. Rudder moment of forces
1.4. Methods for studying the characteristics of the propulsion system

2. Mathematical model of the vessel motion under the influence of the propulsion system

2.1. Coordinate systems used for the mathematical modeling of the vessel motion
2.2. Elements of the vessel motion in a curvilinear path
2.3. The hydrodynamic forces acting on the hull when moving on a curvilinear path
2.4. The aerodynamic forces acting on the windage
2.5. The forces developed by the propulsion system for the ship maneuvering
2.6. Interaction of the propulsion with the hull
2.7. General characteristics of marine power plants
2.8. A mathematical model of the vessel motion
2.9. Development of mathematical models of the vessels motions according to the full-scale tests

3. Basic principles of propulsion and rudder system operation

3.1. Working conditions of propulsion and rudder system for maneuvering the ship
3.2. Theoretical analysis of the of propulsion and rudder system

4. Hydrodynamics of ship propellers

4.1. Propeller jet in an axial flow
4.2. Propeller jet in an oblique flow
4.3. Propeller in oblique flow
4.4. Propeller in a nozzle in an oblique flow
4.5. Circular features of propulsion
4.6. Hydrodynamics of cycloidal propeller
4.7. Propeller load characteristics
4.8. Universal (reverse) propulsion characteristics

5. Ship rudders

5.1. The geometric characteristics of rudders
5.2. Ship rudder in an infinite flow
5.3. Ship rudder in propulsion jet
5.4. Rudders with variable geometry of profile
5.5. Multi-blades system of rudders
5.6. Ships' rudders with rotors

6. Propeller in steering nozzle

6.1. The geometric characteristics of steering nozzles
6.2. Hydrodynamic characteristics of steering nozzles
6.3. Modification of steering nozzles
6.4. U-shaped steering nozzle
6.5. Steering nozzle with rotary stabilizer

7. Thrusters

7.1. Purposes of thrusters

7.2. Structural types of thrusters
7.3. Elements of the theory of thrusters
7.4. Evaluating the effectiveness of thrusters
7.5. Hydrodynamic characteristics of thrusters
7.6. The choice of the basic elements and the hydrodynamic calculation of thruster
7.7. Effect of thruster to running ship and when ship approximation to the wall (pier)

8. The interaction of propulsion and rudder system with the hull

8.1. The presentation of the interaction of propulsion and rudder system with ship's hull and structure of the differential equations of vessel motion
8.2. Characteristics of interaction of propulsion and rudder system with ship's hull

9. Verification calculations of vessel maneuvering

9.1. Acceleration and deceleration of the ship (general concepts)
9.2. Acceleration of the vessel
9.3. Free slowdown of the vessel
9.4. Active deceleration (reverse) of the vessel
9.5. Diagrams of vessel acceleration and deceleration
9.6. Diagram of vessel control
9.7. Curbing the turn of the vessel
9.8. The dynamic play in the control of the vessel unstable on the straight path (the critical angle of the rudder)
9.9. Maneuverability of the vessel at low speed and with decreasing speed of the propeller

10. Design of propulsion and rudder system, which provides a given control of the vessel

10.1. Hull diagrams of the vessel
10.2. Determination of hydrodynamic characteristics of propulsion and rudder system
10.3. Comparative characteristics of propulsion and rudder systems