

DYNAMICS OF SHIPS' PROPULSIVE COMPLEXES



In recent decades, in the theory of complex mechanical and electromechanical complexes, the problems of machine dynamics have become increasingly important. This is primarily due to the need to increase the power of machines, increase their speed, complicate tasks, the solution of which lies with the drives and mechanisms. Therefore, the dynamics of machines included in electromechanical complexes is receiving increasing attention.

A special place in this problem is occupied by the dynamics of the complex “ship hull – propellers – propelling power plant”. This system is called the “ship propulsion complex”.

The working conditions of this complex are peculiar. There are frequent transitions from steady-state operating modes to transient ones and vice versa. The propeller is a connecting link between the ship's hull and the propelling power plant. Both the propeller thrust and the moment of its resistance are complex functions of the angular speed of the propeller rotation and the speed of the ship propulsion. In transient modes of operation, both of these parameters change. Therefore, an analysis of the behavior of the whole propulsive complex and of each of its components is possible only if the whole complex is considered as a single system.

The founder of theoretical methods for analyzing the operation of ship propulsion systems in transient conditions is Professor Viktor Nebesnov, who for many years headed the Theory of Machines and Mechanisms Department of Odessa Marine Engineers Institute. Many of his fundamental works devoted to the joint operation of ship engines, propellers and the hull consider the behavior on maneuvers of a wide variety of vessels, such as trading, ice-breaking, towing, hydrofoils and many others. Theoretical prerequisites are given, analysis methods are developed, the forms of presenting research results that allow extending them to a wide class of vessels are offered.

The works of Viktor Ivanovich laid the foundation for a scientific school, the main direction of which is the study of the dynamics of the joint operation of engines, propellers and hull in transitional and steady-state operation modes. With this approach, it becomes possible to design ship power plants according to the ship quality indicators. A ship power plant is designed to ensure ship operation. There is a possibility to find such ways of a propelling plant control,

in which the vessel performs the task in the best way. In other words, both the design and ship power plants control is carried out according to the final result.

The dynamics of propulsion complexes of ships with electric propulsion is one of the directions of these studies. The electric ships, like no other ships, have a pronounced relationship between the electric propelling power plant and the other components of the propulsion system. The employees of Operation of Marine Electrical Equipment and Automation Department of Odessa National Marine University have dealt with this research area for many years. Numerous scientific publications, monographs, textbooks, and dissertation research have been devoted to studies of the dynamics of electric ships' propulsion systems on maneuvers. V. I. Nebesnov's proceedings acquired further development, taking into account current trends in shipbuilding, in electrical machinery, in new systems of sending energy onto the propellers, the latest achievements in converting technology, based on modern methods and means of scientific research.