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DEVELOPMENT OF AN UNDERWATER ROBOTIC COMPLEX FOR INSPECTION AND LASER CLEANING OF A SHIP'S HULL FROM BIOFOULING

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Shell growths on the underwater part of a ship's hull negatively affect its hydrodynamic performance. A hull overgrown with bioorganisms creates a significant increase in drag forces when the vessel is moving.At the same time, fuel consumption per nautical mile increases, which negatively impacts the speed of cargo delivery and the cost of their transportation.Periodic cleaning of the vessel's hull from biofouling ensures high efficiency of its movement. Inspection and cleaning of the underwater part of the vessel while afloat is carried out by divers using an underwater video system, non-destructive testing devices for hull structures, as well as tools for cleaning surfaces from biological fouling and corrosion products. The aim of the study was to develop an underwater robotic system for remote inspection and cleaning of ships using laser radiation. The article pays special attention to the design of a remotely controlled unmanned underwater vehicle and a laser cleaning module placed on it. The ROV is designed taking into account the peculiarities of its maneuverability under water, providing the ability to inspect and clean the vessel's hull by moving along its surface.A special feature of the design of the device is that its propulsion and steering system is equipped with a pair of wheeled propellers with built-in magnets, which allows the device to move along the steel surface of the ship's hull at the required speed not only underwater, but also in the air.The underwater laser cleaning module, installed on the ROV as a payload, is made using the YLR-15-1500-QCW-MM-AC ytterbium fiber laser and the IPGP 2DMid-Power Scanner 2D surface scanning system. The article presents the main technical solutions obtained for the complex, functional diagrams, models of the designed devices and a photo of the manufactured prototype of the ROV. The results were obtained during the R&D work "Development of a device for underwater laser cleaning of surfaces from biofouling" (contract No. 258 GRNTIS 5/35971) of the joint project of the IMTP FEB RAS and the IACP FEB RAS.

Keywords: underwater laser cleaning, ytterbium fiber laser, scanning optical system, biofouling, ship hull inspection, remotely operated unmanned underwater vehicle, propulsion and steering system, on-board control system

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