MATHEMATICAL MODEL OF THE STRUCTURAL SYSTEM OF A POLYMORPHIC AIR-SEA UNMANNED ROBOTIC VEHICLE

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The rapid development of both information technologies—including hardware (computers, servers, etc.), specialized software (operating systems, etc.), and organizational and methodological support (mathematical and algorithmic support, etc.) – and technologies across various industries: the manufacture of lightweight and durable composite materials, the development of a microelectronic component base (microprocessors, microcontrollers, as well as navigation sensors, radio signal receivers, miniature video cameras with wide viewing angles and high resolution, etc.), satellite navigation systems, etc. – contribute to the active use, continuous improvement, and development of new (polymorphic) mobile unmanned robotic vehicles.

The transition between air and water environments for an air-sea robotic vehicle has a significant nonlinear effect on the aerodynamic characteristics of the lifting systems of advanced polymorphic air-sea unmanned robotic vehicles.

The aim of the report is to Improving the aerodynamic performance of a wing near the air-water interface for an air-sea robotic vehicle.

The report reveals the An analysis was conducted of the Amphibious Vehicle for Autonomous Tactical Aerial & Aquatic Reconnaissance (AVATAAR), an air-sea robotic vehicle developed in India using carbon fiber. The drone can operate both in the air and underwater using sonar. It is equipped with an acoustic communication modem for reliable underwater communication and an Ultra-Short Baseline navigation system, which ensures precise positioning.

A mathematical model of the structural system of a polymorphic air-sea unmanned robotic vehicle is proposed. Analytical expressions for performing the calculations are presented. The model is useful for the aerodynamic design of the vehicle and for simulating its motion over the sea surface. The use of fuzzy set theory and fuzzy inference systems for the efficient design of the apparatus is justified. Practical recommendations are provided for the use of variable-geometry wings, which will improve the efficiency of the apparatus's entry into and exit from the water while ensuring its structural integrity.

References

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