

# RESEARCH AND DESIGN OF ELECTROMAGNETS FOR UNDERWATER ROBOTICS

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**Relevance.** In underwater robotics, a special group of electromagnets can be defined. These electromagnets are retaining by their purpose and work with a certain non-magnetic working gap between the outer anchor and the core. When designing a retaining electromagnet, it is necessary to determine the design parameters that provide the required attractive force at a given operating gap and supply voltage with restrictions on weight and overheating of the winding. There are no calculation methods in the literature that allow solving this problem. Therefore, the study of the characteristics of an electromagnet in holding modes and the development of a methodology for determining the design parameters of an electromagnet that meets the specified requirements is an urgent task.

**Purpose and method.** The purpose of this work is to present the study results of the characteristics and the developed methodology for calculating the electromagnets design used as retention (the presence of a certain non-magnetic gap is the operating mode.). The research methods combine analytical conclusions, field experiments and mathematical modeling.

**Results.** The results of the study contain the proposed methodology for calculating the retaining electromagnet design parameters. This methodology provides the necessary force of attraction at a given working gap while minimizing the mass at a certain supply voltage of the winding and the permissible temperature of overheating of the wire.

**Key words:** electromagnet, working gap, attractive force, permissible overheating, mass minimization, calculation method, thermal (thermal) modeling, modeling of electromagnetic fields.

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