

## REVIEW

by Prof. Dr. Rumen Zdravkov Kishev  
Head of the Bulgarian Ship Hydrodynamics Centre at IMSTCA-BAS,  
Member of the Scientific Jury approved by Order № 116 / 27.05.2020 of the Director of IO-BAS

of the PhD Thesis  
of Eng. Gencho Dinev Georgiev

### **"Floating caisson of pneumatic support type",**

presented for acquisition of the educational and scientific degree "Doctor of Philosophy (PhD)"  
in Higher education area: 4 "Natural Sciences, Mathematics and Informatics", professional field:  
4.4 "Earth Sciences", doctoral program in Oceanology,  
with scientific supervisor Prof. Dr. Atanas Palazov

According to the Order No. 116 / 27.05.2020 of the Director of IO - BAS Prof. Dr. S. Moncheva and Minutes of the first meeting of the Scientific Jury from 10.06.2020 I was appointed an external member of the scientific jury to assess the PhD Thesis, submitted by Eng. Gencho Dinev Georgiev for acquisition of the scientific and educational degree "Doctor of Philosophy (PhD)" in the field of higher education: code 4 "Natural Sciences, Mathematics and Informatics", in professional field 4.4 "Earth Sciences", doctoral program "Oceanology", on the topic "Floating caisson of pneumatic support type".

As a member of the Scientific Jury I have on my disposal:

- Order No. 116 / 27.05.2020 of the Director of the IO - BAS Prof. Dr. S. Moncheva
- PhD Thesis "Floating caisson of pneumatic support type" for obtaining the scientific and educational degree "Doctor of Philosophy (PhD)", Varna, 2020 containing 117 pages.
- Abstract of the above Thesis, Varna, 2020, containing 35 pages.
- List and copies of scientific publications submitted under the defense procedure, 4 pcs.
- A set of documents tracking the work on the development of the PhD Thesis and the preparation of the defense procedure
- Regulations on the terms and conditions for acquiring educational and scientific degrees and for holding academic positions at the Institute of Oceanology - BAS, determining the relevant requirements for the candidate

### **1. General characteristics of the PhD Thesis - content and structure**

The presented PhD Thesis comprise of 117 pages of text, contains 4 chapters, 60 figures, 3 tables and 1 appendix - program code. The list of referred literature includes 67 titles. The work is well structured and documented strictly according to the recommendations of the Regulations of IO-BAS. The abstract is detailed and comprehensive, contains all the necessary information for presentation and evaluation of the work, but does not follow the order of presentation in the dissertation.

The work is dedicated to the development of a new structural element with a high rate of innovation – a pneumatic caisson - for the construction of hydraulic structures and is very relevant in terms of

trends in the expected future human expansion over coastal areas. The development is traced in all stages and brought to the stage of practical application. In the First chapter an extensive literature review is made about the possibilities for construction of hydraulic facilities from concrete submersible caissons and a new technical solution is proposed - the use of caissons with pneumatic support. Chapter Two summarizes briefly the goals and objectives of the study, which has the character of a work plan. The Third chapter deals with the construction of the caisson - materials and technologies for its construction, as well as with the methods for determining the main elements of the caisson. The Fourth chapter is entitled "Results", which sets out all the practical calculations along with the calculation methods, this chapter also includes the methods and results of conducting physical model tests. In my opinion, this is not the best form for presenting the results, due to the mixing of methodological and application parts of the research. This chapter is also the largest in volume. It would be more logical to divide the material in this chapter into two parts.

## **2. Literature awareness and theoretical skills of the candidate**

In the process of working on the dissertation, the doctoral student became acquainted with a large number of published materials on related subject, mainly in English and Russian, as a result of which he acquired a good knowledge of the main theme of the dissertation and related topics. This helped him to orient himself in the development of the non-standard matter, and his good basic theoretical schooling allowed him to formulate and bring to a practical calculation the basic procedures for the creation of the new facility.

## **3. Methodology of thesis development**

The chosen research methodology is based on the theory of statics and dynamics of floating bodies, as well as on the practice of design and construction of hydraulic structures and their elements. Several new calculation schemes have been developed, allowing to take into account the specific features of the proposed technical solution. A very positive moment in the development is the conduct of physical model hydrodynamic tests according to a methodology consistent with the practice of hydrodynamic tests, but modified to specific conditions. This gives a good physical idea of the qualities of the suggested caisson type and will be used in the organization of transportation and laying of the caisson in the place of installation.

## **4. Assessment of the eventual presence of plagiarism in the submitted work**

The themes in the thesis is original enough to have doubts about the possible borrowing of results or texts. In addition, a check was performed with specialized software, which showed zero risk of plagiarism.

## **5. Critical notes**

The general impression of the work is good, but I have remarks in two aspects:

Editorial gaps - single typographical errors, incorrect numbering of figures (for example Fig. 4.3.2.2.1 and 2 are repeated in two places), on some of the illustrations there is no legend to distinguish the curves, some figures do not have an inscription, not all letter designations are defined in the text, etc. omissions. When writing mathematical expressions, the Equation application in Word is not used, which impairs the aesthetic perception of the text.



In the description of the model tests, which are an important part of the development, some specific formulations and details are missing:

- Inclining tests - how many steps have been taken, what heeling weights have been used, how the problem of low stability has been overcome
- Towing tests - with what transversely projected area the coefficients of resistance are non-dimensioned, how the resistance components are divided, how much is the real wet area of the hull, etc.
- Seakeeping tests - the influence of the mass moment of inertia of the caisson on the motion characteristics is neglected, there are inaccuracies in the description of the procedure and the results, for example on page 83 it says "In the transverse position of the caisson according the waves, the vertical motion is greater than at the other course angles", which is physically incorrect.

The above inaccuracies can be explained by the fact that the doctoral student has tried to enter a new subject for him, which on the other hand is praiseworthy.

However, these remarks do not affect the positive result obtained in the development of the dissertation, which has all the elements of a well-conducted study and great practical value.

## 6. Assessment of the scientific contributions

The main contributions declared by the doctoral student are not divided according to their type (scientific, scientific-applied and purely applied), as commonly accepted, and are quite broadly written, mixing the claim itself with the conditions under which it is derived, or with the circumstances of its application. The claims are commented in the table below:

Pretence	Assessment
1. A new type of caisson has been proposed - a floating pneumatic construction, which is a novelty in hydrotechnical construction and has no analogue in the world hydrotechnical theory and practice.	This is a major part of the work, there is an element of novelty protected by a patent. I <b>accept</b> this claim, which is of scientific and applied significance.
2. A method for installation of a caisson with pneumatic support has been developed, in which, using back pressure /vacuum/ in selected or in all working caisson chambers closed only from above and in contact with the ground base, the base contour of the caisson is buried up to some design or limit portion into the bottom. The method of burrying a bottomless caisson and straining the ground basis is a novelty in hydraulic engineering and such a method is not known in world hydrotechnical theory and practice.	This is a direct continuation of the above activity, the method is protected by a copyright certificate, I <b>accept</b> the claim, however it could be formulated more compactly. The claim also has scientific and applied significance.
3. The operating parameters of the project have been validated by a specially tailored experiment with the floating caisson of pneumatic support type, in order to establish some basic hydrodynamic properties (stability, resistance, seaworthiness, etc.) necessary for its transportation from the place	Another important part of the work, performed qualitatively and having an element of novelty, I <b>accept</b> the claim, which can be supplemented with a claim for the development of an original methodology for model tests of this non-standard facility.

of production to the place of installation on situ.	
4. Recommendations are made how to select the design characteristics of a caisson with pneumatic support at a certain configuration of geometric, kinematic and dynamic parameters and conclusions and recommendations are made regarding the static stability, the required power applied to the towing hook and the sea state during towing.	An essential element of the work, I <b>accept</b> the claim as an applied contribution.
5. Recommendations for ensuring the structural characteristics are given and requirements are set for insulation and airtightness of reinforced concrete, while the structure should be produced with account of the variable outdoor temperature and the constant impact of aggressive sea water.	This is an important element of the work, I <b>accept</b> the claim, which, however, is related mainly to design process and should be considered purely applied contribution.

To these claims I would add the methodology for calculating the stability of a floating caisson with pneumatic support, which has an element of novelty due to the non-standard nature of the facility.

#### **8. Evaluation of the quality of the scientific papers, reflecting the research on the dissertation**

The doctoral student has presented 4 scientific publications, reflecting different aspects of the development of the dissertation. Three of them are published in the refereed papers of the Union of Scientists in Bulgaria, and one - in the proceedings of an authoritative international conference, refereed in "Web of Science" with a high impact factor. All publications are at a good level, but the three published in the works of the USB are in Bulgarian, which limits their distribution. In three of the publications the candidate is the sole author, which speaks of the independence of the development and the main contribution of the doctoral student to the results obtained.

#### **9. Originality of the research on the PhD thesis and personal contribution of the doctoral student**

From the overall presentation of the dissertation and the materials to it, one gets the impression that the work has a high degree of novelty and originality, which is reflected in the final part and the claims. There is all grounds and evidence to claim that the work on the development of the dissertation is entirely a personal work of the doctoral student.

#### **10. Motivated conclusion**

After a detailed acquaintance with the materials provided by the applicant, I can conclude:

1. The candidate, Eng. Gencho Dinev Georgiev, has the educational qualification degree "MSc"
2. The applicant is expelled with the right to defense
3. The candidate meets the minimum requirements regarding the number of publications related to the topic of the dissertation



4. The dissertation is presented in a form and volume corresponding to the specific requirements of the primary educational unit - IO-BAS.
5. The dissertation contains scientific and applied results, which represent an original contribution in the field of marine technologies.
6. Claims for scientific and applied contributions are substantiated and correspond to what has actually been achieved.
7. The PhD thesis shows that the candidate has in-depth knowledge of the respective specialty and ability for independent scientific and applied research.
8. The elaboration in the dissertation has a practical application.
9. The examination, performed with specialized software, shows 0% risk of plagiarism, which is a reason to claim that the work on the development of the dissertation is entirely the personal work of the doctoral student.

**All the above gives me a reason to convincingly propose to the esteemed members of the scientific jury to award Eng. Gencho Dinev Georgiev the educational and scientific degree "Doctor" in the field of higher education code 4 "Natural Sciences, Mathematics and Informatics", professional field: 4.4 "Earth Sciences ", doctoral program " Oceanology "**

07.07.2020 г.

Prepared by:

Prof. Dr.

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