



REVIEW

by Assoc. prof. PhD Eng. Radostin Dimitrov Dimitrov
Technical University of Varna

on the dissertation for obtaining the educational and scientific degree of "Doctor" of Mag.

Eng. Stoyan Nedelchev Stoyanov

Topic of the dissertation: " Characteristics of gas injectors for engines"

1. Actuality of the problem in the dissertation

Regardless of the scheme and type of drive, the vehicles produced must meet certain indicators enshrined in international and European regulations. The achievement of certain environmental indicators requires the entire operating process of the engine to be examined, and at the same time it is necessary to determine the impact of fuel supply on the working process under different operating modes of operation of the engine.

The deviation of the fuel parameters from what is necessary for the specific operating mode of the engine is a decisive factor in obtaining the necessary concentrations of harmful emissions in the exhaust gases. This places high demands on the management of fuel supply and the operation of the elements of the fuel equipment. The main element in this process is the gas injector, the operation of which is influenced by a wide range of factors related to both the operating modes of the engine and the temperature conditions of the working environment. The topic covering research aimed at determining the parameters of gas injectors and the hydrodynamic processes taking place in them and their influence on the formation of the cyclic portion of fuel is relevant and is aimed at improving the environmental performance of the engine under different operating modes when working with gas fuel.

The dissertation is in the volume of 167 printed pages, containing 106 figures, 17 tables, and 45 mathematical dependencies. The material includes an introduction, four chapters, conclusions and conclusion, literature used, contributions and an attached list of publications on the dissertation.

2. Knowing the status of the problem

The PhD student has carried out an in-depth analysis of 117 literary sources, of which 18 are in Cyrillic and 99 in Latin.

The analysis of the problem made by the PhD student and presented in 44 printed pages shows the possibility of a thorough and thorough approach used to solve the given problem. With the analysis carried out, the PhD student shows that he knows the scientific achievements in the field of studying the parameters of gas injectors and the hydrodynamic processes occurring in them during the operation of an engine with external mixture formation under different operating modes.

The conclusions made at the end of the first chapter reflect the state of the problem and help to correctly formulate the purpose and objectives of the research.

3. Theoretical model of the study



In the dissertation, chapter two shows numerical modeling of gas-dynamic processes in gas injectors. Numerical modeling was performed using the finite element method, and simulations were made using SolidWorks Flow Simulation. From the simulations made, the results of the change in the mass flow rate as a function of the inlet pressure at different sizes of the studied nozzle were obtained. Approbation of the results obtained has been made, and the data have been compared with real ones from experimental studies. The influence of fuel temperature on the mass flow rate again at different sizes of the studied nozzle was also studied. Other important parameters influencing the supplied amount of gas fuel have been studied, which shows the doctoral student's in-depth knowledge of the topic of the dissertation.

4. *Assessment of the credibility of the material on which the contributions in the dissertation are based*

The reliability of the material on which the PhD student draws his conclusions and claims contributions is based on the comprehensive and in-depth scientific approach to conducting the research. The detailed description of the equipment used in the measurements, the errors in the measurements and the detailed description of the methodology for conducting the research indicates that the PhD student knows the devices with which he works and also participates in conducting the experimental research. The data obtained are determined correctly and correctly, which determines that the analysis of the results is correct and accurate.

5. *Contributions of the dissertation*

The dissertation is a study of the parameters of gas injectors and the hydrodynamic processes taking place in them during the operation of an engine with external mixing with gas fuels under different operating modes. The conclusions made after conducting the experimental studies and processing the results obtained are adequate and clearly show the results obtained from the measurements. The scientific and applied contributions indicated in the dissertation, resulting from the conclusions made, are adequate to the research conducted.

I equate scientific and applied contribution No. 1 with a contribution of applied importance, as it presents the practical development of an experimental facility and the construction of systems necessary for conducting experimental measurements. I accept the stated other scientific and applied contributions as correct and credible.

6. *Assessment of the degree of participation of the PhD student in the development of the dissertation and contributions*

I believe that the doctoral dissertation and the contributions are to a large extent the personal work of the doctoral student Eng. Stoyan Nedelchev Stoyanov, which is confirmed by the above publications to the dissertation. Knowledge of the matter and the participation of the dissertation student in the conduct of experimental research is evident from the topics of the presented scientific works to the dissertation and the figures and graphics presented in the dissertation. No information is provided regarding the detection of plagiarism in the dissertation, as well as checks carried out in this area.



I definitely believe that the PhD student independently with the help of his supervisors has developed his dissertation and the indicated scientific and applied transfers in the dissertation are the personal work of the dissertation.

7. *Evaluation of the publications of the dissertation*

Of the four publications mentioned, one is independent and three are co-authored with one of the supervisors. Two of the publications submitted to the dissertation are indexed in world-renowned databases. Foreign scientists also participate in two of the presented publications, which shows good potential for the future scientific work of the PhD student.

There is no evidence of open citations of the scientific papers attached to the dissertation.

8. *Use of research results in scientific and social practice*

The results of the dissertation have great scientific and applied potential. There are no documents attached to the dissertation for implementation in practice or for high scientific achievements. However, the results obtained have the potential to achieve major socio-economic benefits in the use of gaseous fuels in external blending engines.

9. *Implementation of the research results*

The results of the dissertation are useful and are subject to direct use and implementation in practice in the creation of an algorithm for controlling gas injectors in the processing of a conventional internal combustion engine or in the production of a new one to achieve the optimal parameters for fuel supply and improve environmental performance. Their implementation in the educational process is also completely adequate.

10. *Evaluation of the abstract*

The abstract submitted to the dissertation fully meets the requirements of the Technical University of Varna, reflecting fully and accurately the main provisions of the dissertation. I have no comments about the formatting of the presented draft of an abstract.

11. *Critical remarks*

I have no comments on the presented dissertation. The initial remarks made have been removed entirely. The dissertation is a useful experimental study with a specific contribution in the field of fuel supply and determination of the parameters of gas injectors and the hydrodynamic processes taking place in them during the operation of an engine with external mixing with gas fuels under different operating modes. The presented dissertation fully meets the requirements for the submission of a doctoral dissertation and an abstract under the Law on the Prevention of Corruption and Corruption Act.

12. *Other questions regarding the review*

I have no additional questions that are directly related to the presented dissertation and abstract.

13. *Conclusion with a clear opinion*

From the presented evidence and analyses, it can be seen that the defended



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contributions in the doctoral dissertation are significant and are oriented towards the practice in the field of fuel supply and determination of the parameters of gas injectors and the hydrodynamic processes taking place in them during the operation of an engine with external mixing with gas fuels under different operating modes.

Taking into account the relevance, scientific level and contributions of the dissertation relating to a problem whose solution is of great ecological and economic importance, I believe that the dissertation submitted to me for review can be given an overall **positive** assessment.

I propose to the Honorable Scientific Jury to award to the PhD student Stoyan Nedelchev Stoyanov the educational and scientific degree "**Doctor**" in the scientific specialty "Internal Combustion Engines" in PN 5.1. "Mechanical Engineering".

02.12.2025
Varna

Reviewer:.....
/Assoc. Dr. Eng. R. Dimitrov/