

OPINION

From: **Prof. PhD Eng. Krasimir Todorov Krastanov**
Member of the Scientific Jury appointed by order No 275/08.05.2025 r.
of the Rector of the Technical University - Varna

Subject: Dissertation for the award of an educational and scientific degree "**doctor**" in scientific field 5. "Technical Sciences", professional field 5.1 "Mechanical Engineering", doctoral program " Internal Combustion Engines" combustion "

Author of the dissertation thesis: **M.Eng. Daniel Zdravkov Ivanov**

Dissertation topic thesis: **" Investigation of the braking properties of a car with an internal combustion engine "**

Scientific Head: **Assoc. Prof. Dr. Eng. Radostin Dimitrov Dimitrov**

The opinion is prepared on reason solution from the first meeting on scientific jury , appointed by order of the Rector of TU – Varna .

1. Relevance of the developments in the dissertation work problem.

The dissertation examines an extremely topical issue related to road safety in road transport. The main goal of the work is to study and determine the parameters of one of the critical processes, extreme braking of the vehicle, which is of utmost importance for preventing or minimizing damage in road accidents.

The behavior of the car in such situations is characterized by increased dynamics in the development of its negative acceleration, which requires the application of modern research methods and a specific approach to the analysis of fast processes. To solve the problems posed tasks, an original experimental method was developed installation, which gives opportunity for measurement of small vehicle displacements with high accuracy and synchronous registration of processes in real time.

Algorithms and methodology have been developed for pre- and post- processing of experimental data and studying the phase parameters in the vehicle's deceleration characteristics.

An experimental study of the extreme braking of two cars with different drive schemes has been carried out. The experimental data obtained represent reliable information about the effects of the joint action of the braking system and the operation of the vehicle's drive systems in braking mode. The applied scientific approach used in solving the tasks set in the dissertation demonstrates a thorough knowledge of the research problem and fully corresponds to the researched issues.

Vehicle deceleration data are useful for analyzing and modeling vehicle behavior during braking. They allow for assessing the effectiveness of control systems and improving automatic control algorithms, which is especially important for minimizing risks in emergency situations. In the context of modern safety requirements and technological progress, the study and analysis of vehicle deceleration is an important and topical problem that has direct application for the development of more reliable, intelligent, and safe transportation systems.

2. Scientific and applied scientific contributions of the dissertation labor

The dissertation work has an original contribution to science, thanks to the achieved scientific and applied results, realized through the introduction of effective methods that correspond to modern achievements in the research field.

The scientific and applied contributions presented in the dissertation can be summarized as follows:

- An innovative method has been developed to determine the phases in periods of extreme braking through the analysis of experimental data.
- A methodology for pre-smoothing the lengths of elementary periods when moving the car and for correcting hardware interruptions through confidence intervals is proposed. A methodology for smoothing data for processes with variable dynamics is improved.
- The limits and duration of the extreme braking phases of mid-range cars have been determined. The influence of the initial conditions on the period of movement with maximum negative accelerations has been established.
- Research has been conducted and the oscillatory processes during the different braking phases have been analyzed, determining the amplitudes and frequency spectra of the significant harmonics .
- A system for precise measurements and high-frequency registration of vehicle displacement data has been developed. The system allows, through a specially developed sensor and connection with signals external to the system from the vehicle control, to synchronously register experimental data in real time.

I believe that the contributions made by the doctoral candidate will be useful for science. and practice.

No plagiarism was noticed in the dissertation. labor.

3.Opinions, recommendations and notes.

The main results of the dissertation have been reported and discussed at scientific conferences, thus becoming known in the scientific community. The publications presented with the dissertation are four in number, one of which is independent, and the other three are jointly developed with the scientific supervisor and other authors. They are directly related to the dissertation and reflect indisputably achieved by the dissertation candidate results. Publishing the results of the study in scientific journals contributes to their visibility and recognition in the scientific field.

The abstract complies with the requirements set by the Technical University of Varna and indicates the goals of the scientific work and the methods. on research. It reflects the content of the dissertation work, briefly and clearly summarizing the scientific work performed and the results achieved.

The dissertation represents a comprehensive and completed scientific study. with formulated problems, developed methods and tools for research, a substantiated theoretical basis, research of real objects, analysis of the results obtained and conclusions.

CONCLUSION

The dissertation work, in its structure, volume and content, complies with all requirements of the Act on the Development of Academic Staff in the Republic of Bulgaria and The Regulations for its implementation for the award of the educational and scientific degree "DOCTOR", as it contains the necessary scientific - applied and applied contributions.

As a result of all the above, I propose to the Honorable Jury that awards to Eng. Daniel Zdravkov Ivanov, the educational and scientific degree "DOCTOR" in the doctoral program "Internal Combustion Engines", field of higher education 5. "Technical Sciences", professional field 5.1 "Mechanical Engineering".

Date: 04 June 2025

JURY MEMBER:

/Prof. Dr. Eng. Krasimir Krastanov/