



**Universitatea  
Transilvania  
din Braşov**

# **HABILITATION THESIS**

## **SUMMARY**

**Title: VEHICLE SAFETY AND PERFORMANCE - APPROACHES AND  
CHALLENGES**

**Domain: MOTOR VEHICLE ENGINEERING**

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**University :Gheorghe Asachi ,Iasi**

**BRAŞOV, 2023**

**Summary**

The habilitation thesis includes part of the activity and research results obtained by the associate professor of engineering. Adrian Constantin Sachelarie, currently Associate professor at the "Gheorghe Asachi" Technical University of Iași, Faculty of Mechanics, Department of Automotives and Mechanical Engineering, on the main areas of study, interest and developed after the public presentation of his doctoral thesis in 2001.

The habilitation thesis has a structure with three large chapters/sections, namely (I) academic and professional achievements, (II), the results obtained in scientific research, and (III) the perspectives of scientific and professional career development.

In the first section, I presented the milestones of my teaching career, starting in 1991 when I started my university career as a university assistant, until now. After the public presentation of the doctoral thesis with the title: Research on increasing the cyclical stability at M.A.I. operating with very lean mixtures, the serial diploma. B no. 4210/10.04.2001, a title granted by the Technical University "Gheorghe Asachi" of Iași, (scientific leader Prof. univ.dr.eng. Mircea ZUGRĂVEL) in the field of Mechanical Engineering I continued the teaching and research activity in the field/specialization graduated in 1988, that of mechanical profile engineer, Thermal Machines Specialization. The transition to the field of Automotive Engineering/Road Vehicles was natural, gradual, and irreversible, increasing the interest and number of students towards this specialization, but with the maintenance of the teaching and research activity that also includes the initial specialization. During the more than 32 years of my teaching career, I continued the tradition of the Iasi School of engineering in the field I graduated from, and since 2001 I can say that I had a decisive role in the growth and consolidation of the Automotive specialization in the "Gheorghe Asachi" Technical University of Iași, Department of I.M.A.R., Fac. of Mechanics.

The professional results and those from scientific research motivated and determined me to continue these activities in the field of Automotive Engineering at a higher level by obtaining the qualification certificate.

In the second section, the most important results of the research activity carried out in the framework of some projects/grants won through competition or with the economic environment in Romania, but also through the active participation in support/coordination/tutoring/guidance activities of the students and doctoral students of the specialization of Road Vehicles or the teaching staff of our department are described briefly and concisely.

The research directions described in this paper refer to the studies carried out in the field of Road Vehicles, in turn detailed in chapters: (i) lean mixtures S.I. combustion engines; simulation of engine operation; the fuel mixture formation and burning process; pollution reduction in I.C.E.; experimental research and simulations of the exploitation of these engines on motor vehicles (ii) studies related to traffic safety, traffic performances and road accidentology; the accidents dynamics and investigation (iii) vehicle systems; air conditioning and confort systems.

The results of research carried out in the case of an experimental spark ignition engine with two combustion chambers, operating on flame jet and lean mixtures. The air-fuel ratio of the mixture in combustion chambers of the engine influences both engine efficiency, as well as the composition of combustion gases. Spark-ignition internal combustion engines produce exhaust gases that contain carbon monoxide, nitrogen monoxide, and unburned or incompletely burned hydrocarbons. All these exhaust gases contribute to air pollution. In order to reduce polluting components from internal combustion engines and thus to decrease overall air pollution, it is necessary to remove harmful components from the exhaust gases of internal combustion engines to the greatest extent possible. Regular gasoline engines operate at their best when the air/fuel ratio approaches the stoichiometric ratio. The use of the stoichiometric air/fuel ratio is also advantageous for the proper functioning of the three-way catalyst that carries out the oxidation of carbon monoxide CO and hydrocarbons HC, but also for the reduction of nitrogen oxides, NO<sub>x</sub> from the engine exhaust gases. At this ratio, harmful components in the exhaust gases of automobile engines can be converted into harmless compounds such as CO<sub>2</sub>, nitrogen, by applying an afterburner to the exhaust gases, producing hot exhaust gases that then pass through a catalyst.

Experimental research and simulations of operation on these engines, have been highlighted through publications where the results have been disseminated.

Another aspect of the habilitation thesis refers to the studies of the dynamic behavior of motor vehicles to increase their dynamic performance and confort, as well as studies related to safety, traffic performance and accidentology. Given the massive penetration of the automobile into human activities as well as the ability of drivers to offer a lot of interpretations and nuances to a road event, the erroneous opinion was formed that any holder of a driver's license is also an expert in traffic safety. Given the massive penetration of the automobile into human activities as well as the ability of drivers to offer a lot of interpretations and nuances to a road

event, the erroneous opinion was formed that any holder of a driver's license is also an expert in traffic safety.

The street networks design in localities, the dimensioning of intersections, the design of routes and transversal or longitudinal profiles of roads and highways, are based on data obtained from the study of vehicle movement dynamics. The elements that define vehicle dynamics, acceleration, deceleration, maximum speed, the ability to climb ramps or the ability to turn, are used for the dimensioning and design of signaling and traffic management systems in the existing road system, or are used for optimization design. Accidentology could be defined as a technical discipline that studies, using scientific methods, traffic events resulting in bodily injuries, taking into account all the circumstances and influences, in order to develop effective, but also rational, solutions to reduce the number of accidents and improve their severity. It has a precise theme related to the risks to which road users are exposed depending on the category of road user, the sex of the vehicle occupants, human behavior, the particularities of the road, climatic conditions, etc.

In the last part of the thesis, the most recent and important bibliographic references thoroughly studied for the development and support of this habilitation thesis are mentioned. The present thesis reflects the professional experience and the results of the research. Finally, the research and development directions of the career are presented. For the didactic part, the improvement of teaching methods and the updating of the content of the taught courses are targeted, and for the research part, the main targeted directions are given, on topical issues for road traffic safety and performance, within future research projects, with mixed groups of teaching staff and students and PhD students, with the economic environment or through grants attracted following national or European competitions.