



Universitatea *Transilvania* din Braşov

**HABILITATION THESIS
SUMMARY**

**Implementations of Advanced Mechatronic Systems in Agriculture,
Industry and Medicine**

Domain: Mechanical Engineering

**Author: Assoc. Prof. Dr. Eng. Marius Cristian LUCULESCU
Transilvania University of Braşov**

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Habilitation thesis entitled *Implementations Advanced Mechatronic Systems in Agriculture, Industry and Medicine* does a review in the first section, of the most important author's scientific and professional achievements starting after obtaining the PhD degree until now and presents in the second section, the evolution and development plans for career development that define the goals for the next period.

The entire research activity conducted within the period referred within is according to the mission of *Advanced Mechatronic Systems* Research Centre, meaning the development of highly complex research in high performance mechatronic systems implemented in industry, agriculture and medicine. For all this research it was considered as main objective the transfer of results to practical applications that make a direct contribution to improving people's lives. The research topics are in perfect accordance with the research center topics and aims to implementations of mechatronic systems in agriculture (a), industry (b) and medicine (c).

(a) The first research direction and that with the most significant achievements wants to make a major contribution to the development and improvement of **precision farming** through conception, design, development, testing and validation, and to improve **models of mechatronic systems used to monitor the crops vegetation status**. This is possible by using *vegetation indices*, values calculated after measuring the reflectance of sunlight on the surface of the plant and its correlation with the development status and their health. This helps answer before you actually see if a crop needs water, nutrients to grow optimally or a pesticide to help in the fight against pests. Two important projects are coordinated by the author as director on this topic. First develops two functional mechatronic systems, a terrestrial one and an unmanned air vehicle namely a drone with which we practically move over the crop the data acquisition systems specially designed. Data collected will represent inputs of a software system that will calculate the vegetation indices, will geo-reference (will correlate with the geographical position the points where data was collected), and can generate maps of favorability and risk, giving an interpretation of them. The second project improves an existing multispectral mechatronic system from one of the project partners in order to increase capture performance of vegetative parameters.

(b) Research conducted on **implementations of advanced mechatronic systems in industry** focused on two research, development and innovation contracts with third parties, as director; on participation as a research team member in grants obtained by national competitions and on research collaborations. In this respect two achievements were more consistent, one that covers the design and implementation of a mechatronic system for monitoring and management of individual vehicles or fleets automotive vehicles, and the other relates to remote monitoring

environmental parameters from storage buildings using Wireless Sensor Networks and control environmental parameters from the inside using similar equipment.

(c) The third direction, **implementations of advanced mechatronic systems in medicine**, has directed research to: *using artificial intelligence techniques in Imaging Computer-Aided Diagnosis*, a continuation of research from the PhD thesis and taking advantage of its achievements; *design and development of advanced mechatronic systems for assisting patients*; applications of medical informatics in research of the colleagues from the Faculty of Medicine. Important results obtained were the starting point for collaboration with partners and research institutes abroad.

The scientific and professional achievements of the author of this Habilitation thesis take into account research projects, patents, books, articles published in journals, participation in international conferences, organization of workshops, documented visits, participation in scientific sessions, products and innovative technologies obtained by all this work, each of them putting its mark on the author's personal development.

Over the years, the author has gained important experience in coordinating research teams, setting goals and carrying them out successfully completing them on time, within the limits of budgets and fulfilling technical standards and quality requirements.

The research results were and always will be the starting points for further research.

The second section of the thesis contains the evolution and development plans for career development that were structured on four areas: education and training; teaching activity; research; local, national and international visibility. For each of them the current context was identified and there were proposed explicit measures and realistic deadlines.

Getting the habilitation certificate will reward all the authors' efforts to date, but it will be also a moral obligation for him to transmit all the experience gained in the research to doctoral students, to those who should assume the mission to continue our work skillfully, diligently, passionately determined to face new challenges. It is up to us to plant the love for this job in their souls and do it to germinate and bear fruit. It will look like a souls' and minds precision agriculture of tomorrow people...