



Universitatea *Transilvania* din Braşov

HABILITATION THESIS

SUMMARY

**Technical-medical Approach of Biomechanical and Behavioral
Factors in order to Improve Life Quality**

Domain: Mechanical Engineering

**Author: Assoc.prof.eng. Cotoros Laura Diana, Ph.D.
University Transilvania of Brasov**

BRASOV, 2016

SUMMARY

The purpose of any priority based research is to address major concerns shared by European citizens and everywhere. This is the reason why different fields of research should bring together their resources and knowledge in order to be able to focus upon innovative and human centered activities.

One of the most beneficial blends between research fields is the one harmonizing engineering technologies with medical knowledge. The impressive progress of medicine during the last decades would not have been possible without the undeterrable support of technical input. The interdisciplinary contribution of various branches of engineering lead to extraordinary results which are gradually accessible to more and more human beings, improving their life quality and conditions or at least this should be the ultimate purpose.

Keeping in mind these desiderates, the author presented throughout the entire work, a number of significant research results that meet the requirements of a human centered and technical applied research. Thus the work is divided into two important parts: one is dealing with the scientific and professional achievements of the past years and the other with the plans of career development in the future.

The scientific part of the work presents along four large chapters the main research directions which were approached during the most recent years of activity and also a synthesis of the main conclusions and original contributions resulted from the above mentioned work.

The first chapter presents mainly the issues related to human motion, which was approached by the author based upon the solid fundament of Mechanics knowledge gathered during the first years of academic activity. This knowledge was thoroughly extended to human applications both by experimental approaches and aided by computer science. Thus, the possibility of comparing the normality with accidental locomotion dysfunctions occurred but also with those incurred by occupational activities, which may be routine professions or performance demanding jobs. The results obtained by computer modeling and simulation are corroborated with the experimental tests developed by innovative methodologies and supported by performant equipment existing in the university research laboratories.

The second chapter deals mainly with the analysis of the biomedical materials used for both dental works and orthopedical devices. These materials should comply with more severe conditions due to the fact that besides the required mechanical, chemical and thermal properties they need to be biocompatible as they will be in close contact to human tissues. Of course, here comes again the interdisciplinary collaboration between engineering, medicine and chemistry, as engineers are able to only deal with mechanical and thermal properties and less with the chemical and biological ones. The research aimed mostly at analyzing the existing materials properties in order to offer a reliable and scientific instrument to both users (medical staff) and

beneficiaries (patients) in selecting the optimal choice for each individual. Some research are already initiated and will continue in order to identify new materials that meet the requirements of the biomedical use and additionally present the advantage of lower costs and environmental damage. Composite materials are the most promising alternative and their particular structure may offer various and creative combinations to meet the requirements in the future.

The third chapter provides an original analysis of the environmental factors influence upon various activities of the human being. Starting with visual and noise effects, pollution due to solid particles in the working environment and going on with the environmental influence of building insulation upon the life quality, the research is focused mainly on the human factor and on the manner in which certain environmental aggressions may affect its welfare. People are surrounded nowadays with potentially dangerous challenges because technology did not come only loaded with benefits but has also some unfortunate shortcomings. Here comes the collaboration between mechanical and environmental engineering with the invaluable contribution of the medical side. Also, provided the statistical processing knowledge of the author, numerous assessments can be made in order to meet the optimal choice for all concerned: people, environment and technology, but also to perform pertinent analysis of existing situations in order to be able to propose improvements or innovations.

The fourth chapter synthetizes in two subchapters the main conclusions achieved during the presented researches and studies and the original contributions of the author with respect to the state of the art.

The second main part of the thesis is dedicated to the evolution of the scientific and professional career of the author and also to the future development plans of both academic and scientific career. Coming from a hi-tech industrial environment like aircraft industry, with a strong desire of learning and researching new directions and being able to teach others, the author has been moving along a steady ascending career during the years and hopes that the present work will be another step ahead on this path. Future may provide a fruitful and beneficial collaboration between the technical, medical and environmental professionals with the purpose of building an integrated and correlated system serving mankind welfare.