Abstract

The present habilitation thesis was structured in five sections: (I) Introduction, (II) Scientific achievements, (III) Academic and professional achievements, (IV) Career evolution and development plans and (V) References. The scientific, academic and professional achievements covered the period from 1998 to 2015.

Section (I) give an overview of the thesis content and shows the highlighted papers which were published by the author in ISI indexed Journals (2), Inspec indexed Journal (1), ISI indexed Conferences (2), Scopus indexed Conferences (2), Springer Link indexed Conference (2) and one awarded paper on 3rd Asian IFToMM Conference on Mechanism and Machine Science in Tian Jin.

The Section (II) described some of the scientific achievements within the author´s research directions and was organized in four chapters. Each chapter has a unitary structure usually including: *(a) State-of-art* on the research topic and research problem statement; *(b) Theoretical and/or experimental contributions* to the described problem, highlighting the aim, analytical background, numerical examples, applications or experimental results; (c) *Scientific contributions of the author*.

The first chapter "Scientific achievements regarding the design of the mechanisms using profiled wheels" shows the contributions on computing of the base circle radius and evaluating of the wear susceptibility of the cam mechanisms with translating or oscillating flat-face follower, and on the designing of different non-circular wheels of belt mechanisms for self-balancing applications.
The development of a unitary numerical method to compute the base circle radius was shown in the case of cam mechanisms with oscillating or translating flat-face follower using a base circle radius function. The method is based on the mathematical conditions to avoid the inflection or singularity points on the cam profile.
The second study in this chapter used the specific relative sliding as a characteristic parameter of the cam mechanism with oscillating or translating flat-face follower, in a unitary evaluation of cam mechanism's susceptibility to wear.
The using special type of belt mechanism structures were also studied and developed for self-balancing mechanisms. Some technical applications in the field of mechanical devices, measurement tools and robotic shown the computation algorithms in order to design the used non-circular wheels.

The second chapter "Scientific achievements regarding the design of complex mechanisms structures" laid out contributions in designing of geared linkages with non-circular gears and with linear actuation, respectively of 5-link belt mechanisms.
The study of geared linkages with non-circular gears presented the type synthesis, the approach for computing the centrodes and the transmission functions of non-circular gear pairs or centrode segments with nonlinear boundary conditions. The proposed general computation method allows the computing of ordinary non-circular gears pairs and planetary non-circular gear pairs.

Another special structure of the geared linkages with linear actuation was studied regarding the type synthesis, development the analytical analysis and dimensional synthesis method. An application using geared linkages with linear actuation was shown for designing and control of an active knee prosthesis.
The using of belt mechanism in mechatronic applications required the adjustment of the variable link lengths to the various movement tasks, which needs the increasing of the degree of freedom of the mechanisms and the using of circular wheel instead of a special profiled non-circular wheel. The computation of control functions mechanism was shown for different movement task and for a walking leg with 2 DoF.

The third chapter "Scientific achievements regarding of mechanism development for mechatronics, robotics and mechanical applications" presents some mechanism design and control applications for haptic exoskeleton used in space telerobotics, for a new class of planar parallel manipulators and for a fishing reel spool mechanisms.
The first application showed the developing strategy of a new lightweight, easy wearable and comfortable haptic arm exoskeleton for teleoperation with a robot having equivalent kinematic chain and with force-feedback. The chapter focuses on the specific design and control solutions for the elbow module of haptic arm exoskeleton, meant to enable force-feedback telemanipulation with redundant robotic arm (slave robot).
The development of the specific class of planar parallel manipulators using geared linkages with linear actuation was presented in the second application. The study focuses mainly on the kinematic analysis and the problem of singularities.
The third application developed a study of the existing or new mechanism solutions to provide axial movement of the spool with constant speed in a large range of the movement. The novel solution was finally manufactured, tested and patented.

The last chapter "Scientific achievements regarding the analysis of compliant mechanisms" shows the research of the compliant mechanisms, which use elastic connections, focused on the structural analysis of the compliant mechanisms with elastic connections, simulation and dynamic analysis of the compliant mechanisms with or without integrated piezo-actuators. The theoretical research reconsidered the definition of the kinematic joint, of the link and expressed a new formula for computing of mechanism's degree of freedom (mobility). Some alternative kinematic models of A-CM with active prismatic joints and rotational joints, having concentrated torsion rigidity and the ability to predict the actual motion of compliant mechanisms with integrated piezo-ceramic actuators were proposed and dynamic analyzed using Adams and Mathlab-Simulink.

The Section (III) of the habilitation thesis mentions the main achievements of the candidate within the last 17 years after defending the PhD thesis in co-advisorship between University Politehnica Timişoara and Technical University Dresden, defended on 27th of February 1998 at TU Dresden and on 03 of June 1998 at UP Timişoara. The teaching activities at the University Politehnica Timisoara comprised "Mechanism Science" and "Programming and Using of Computers", continuing with teaching on "Intensive Therapy Biomedical Devices", "Prosthesis", "Advanced Robotics", "Special Structure of Robots" and "Service Robotics". The teaching classes were held in German and Romanian language. The concentrated teaching classes at the TU Dresden, Szent István University in Gödölö and National Taiwan University of Science and Technology enriched the candidate the international teaching experience. A number of 6 books and course supports were published.

The research activities were developed in parallel with the teaching activities in the same research areas. The candidate leaded 5 research projects/grants as project coordinator or partner leader and was involved in 17 research projects at the UP Timişoara, TU Dresden and TU Ilmenau.
The publishing activity during this period as result of the research and development activities was very extensive, so I published 5 papers in ISI Journals, 11 papers in Scopus, Elsevier Science Direct and Inspec indexed Journals, 26 papers indexed ISI Conference, 27 Scopus, IEEE and Springer indexed conferences and other 69 papers without indexing in different national and international conferences and IFToMM World Congresses
The publishing activities were compleated with reviewing activities on main Journals and Conferences. From 2009 the candidate worked as member of the scientific committtee of the University Journal "Bulletin of the Transilvania University of Brasov" and from 2013 as editorial office secretary for the International Journal "Robotica & Management". In 2015 became Associate Editor by the Journal Advanced Robotics Systems.

The candidate was involved in three national and intenational profesional organization ARoTMM (Romanian Association of Mechanism and Machine Science) associated to the International Federation of Mechanism and Machine Science IFToMM (up 1991), SRR Romanian Society of Robotics (up 2000) and VDI -Verein Deutscher Ingenieure (up 1996). For two terms was elected as member in the IFToMM Permanent Commision for Constitution (2004-2011) and currently chaired the Technical Committee Linkages and Mechanical Controls. At the national level from 2005 worked as scientifical secretary of the national organization ARoTMM

Organized as chair or as co-chair several international Conferences and edited 5 books with the IFToMM Conference papers by Springer and Trans-Tech Publisher.

After the PhD defend received several post-doc and teaching fellowships in Germany (Humbold and Erasmus), Hungary (Pro Renovanda Cultura), Italy (Erasmus) and Taiwan.

To the academic and professional career was added a managerial activity as Head of the Mechatronics Department of the University Politehnica Timisoara for 2 periods, from 2008 up today.

The Section (IV) shows the career evolution and development plans organized in the following systematization: Key research directions, Objectives, Planned activities and Financial, human and infrastructure resources.

The Section (V) contains the references used in the section "Scientific achievements".