



Universitatea *Transilvania* din Braşov

**HABILITATION THESIS
SUMMARY**

Title:

**Remote Engineering and
Virtual Instrumentation**

Domain:

**Electronic Engineering, Telecommunications and
Information Technologies**

Author: Prof.Dr.Fiz. Doru URSUTIU

University: “Transilvania” of Brasov

BRASOV, 2016

Habilitation thesis entitled:**“Remote Engineering and Virtual Instrumentation”**

represents the sum of efforts put into development and the main scientific contributions of the author in this field that, as visible all through the thesis, undertakes the task to cover two important directions in Physics and Electronics:

- **Noises and Fluctuations new Materials and Devices**
- **Nanosystems and Nanotechnologies**

From the very beginning of the thesis the author intent is to present the educational and research capacities, in their logical development and following their gradual evolution.

The interest for this field began with the Ph.D specialisation of the author at „Babes Bolyai” University in Cluj Napoca, within the Department of Electronics and Solid state physics with main theme:

The study by noise and fluctuation measuring of amorphous and polycrystalline materials for circuit components,

theme highly connected with the two above mentioned aspects.

The postdoc researches are strongly connected with the academic activity of the author and are both based on the idea to create a *personal field of research* oriented to *scientific and educational research* that could reflect the abilities that the author gained in the field of applied researches in connected to the industrial - applicative field that could facilitate a solid support for education.

The first years in „Transilvania” University are linked with the consolidation of his research in “noises and fluctuations”, efforts that brought annually one research project in “Transilvania” University and that laid the grounds of the collaboration with Thin Films Laboratory from Institute of Physics and Technology of Materials IFTM Bucharest. These aspects are presented in the chapter “Introduction - General Overview” and highlights the beginning of the international collaboration with the Faculty of Physics from Lancaster University - UK (<http://www.lancaster.ac.uk>), more specific, with the Laboratory of Noise and Fluctuations coordinated by a highly esteemed academic Prof.Dr. B.K.Jones. In this manner we laid the grounds of a Laboratory for Noise and Fluctuations within “Transilvania” University in Brasov.

In the introduction two important moments in the development of the research directions and of the consequent capacities of research are being presented and they are the beginning of the partnership with University for Applied Sciences - Villach AUSTIA, together with professor Michael Auer with whom the author launched in 2004 the International Conference for “Remote Engineering and Virtual Instrumentation” (<http://www.rev-conference.org>) and immediately, in 2005, the idea to organise one strong international association “International Association of Online Engineering IAOE” (<http://online-engineering.org>).

As it will be visible from the other chapters of the habilitation thesis, once the grounds of the field laid and of the two research directions, the main focus is on strengthening the group on university level, on acquiring instruments and performant equipments and on developing on a local level of a structure called Center for Valorization and Transfer of Competence CVTC. This new structure was created as a structure oriented on education and educational research and it started as a consequence of two european projects:

- CME – TEMPUS – 01220 – 1995-1996, “*Centre pour la Formation des Ressources Humaines et L’Actualisation des Connaissances Techniques par des Techniques Interactives Informatiques*”, financed with 42000 ECU
- TEMPUS – JEP, 1997-1999, “*CVTC - Center for Valorization and Transfer of Competence*”, in collaboration with France, UK, Spain and financed with 300.505 ECU

Gradually, all the activity starts to be developed and implemented under CVTC that thus becomes an independent unit with its own status and that this year will celebrate 15 years of intense activity, subordinated to scientific and educational research, being in the same time a common ground in all collaborative activities and competence transfer from and towards the industry.

We need to sum-up a series of important activities presented in paragraph 1.2 to 1.11 that are part of the “Introduction“ and belong especially to the “General Overview” of the maturity phase of the research field:

- general overview of the expertise field
- several aspects related to main focuses of the research field that marked the postdoctoral period

- the management and the active role played by CVTC with its educational and research laboratories, well equipped and recognised on national and international level
- New labs: *The Creativity Laboratory*, *Noise and Fluctuations Laboratory* and the newest one, the *Nanosystems and Thin Layers Laboratory “Radu Grigorovici”*
- the increased visibility of the international activity of CVTC by its research activity recognition, by appointing and reappointing of the author as head of International Association IAOE
- ongoing of important international research projects FP7, NATO, etc. and of many other in the field of education and educational research Socrates, Tempus, Erasmus, Leonardo etc. It is worth mentioning here the european project “*Master in Remote Engineering – MARE*” that highlighted both the diversity and complementarity of attendants competencies - in relation to engineering technologies for remote control and remote assisted learning.
- One of the intense sustained activities of CVTC is linked to the industrial partnership developed with well known companies that enabled: the immediate access to new technologies, special possibilities to implement these technologies in industrial applications and in education by gaining more grants within industry and last but not least the constant modernisation of CVTC equipments. We can list some of these partners: PEMSTAR (now Benchmark Electronic) Holland, EchoChemie (now Metrohm) Holland, National Instruments USA, Agilent Technologies (now Keysight Technologies) USA and Malaysia, EMONA Australia, etc.
 - On a national level, CVTC is being recognised by its multiple applications implemented on industrial level: more contracts with IAR- Brasov (automatic control of a polymerization oven, automatic weight system and establishing the weight centre in helicopters, wireless LabVIEW controlled system form monitoring the temperature in galvanic bath and a complex energy monitoring system for the whole aeronautics company. It is here as well that we need to mention the collaboration of Romania with STEINEL company from Germany, following which several intelligent illumination systems with LED’s developed in CVTC were put on the market.
 - CVTC manages to draw international funding: e.g. Dutch government finances that competence transfer in CVTC at the company Pemstar - Brasov, and together a performant „Impedancemeter” is realised for EcoChemie, Holland - that is being sold on the market of modular electrochemistry equipments.

In paragraph 1.8 a consistent presentation is being made, more like a synthesis of several grants for scientific research on national and international level, grouped on the three main ideas

followed: *Launch and Consolidation of CVTC, Remote Engineering and Virtual Instrumentation* and, last but not least, *Noises and Fluctuations in New Materials and Devices - Nanosystems and Nanotechnologies*.

In the past paragraphs of the introductory part and general overview are highlighted the educational activities in the university sustained by CVTC team and especially those backed up by equipment endowment that was attracted for CVTC and the university. In this part are presented the actions that refer to the development of the centre and launching of academies that sustain the educational involvement: *Microsoft Academy, CISCO Academy, LabVIEW Academy*. The measurable results of these activities in both scientific and educational research are visible in the publication of several “books and book chapters “ in academical and scientific recognised national and international publishing houses, the publication of articles in prestigious publications and especially by the participation in a large number of international conferences thus better disseminating the results of CVTC.

The full recognition of the activities within the field of Engineering Education comes when **“International Society for Engineering Education” (IGIP)**, Austria, Klagenfurt (founded in 1972) grounds the author the title of **„International Engineering Educator HONORIS CAUSA „ING.PAED. IGIP h.c.” for outstanding contributions in the field of Engineering Education and for long time dedicated work as engineering educator**, during the International Conference in KAZAN on September 25th, 2013

In the Chapters 2, 3 and 4 several ideas presented in the introduction are developed in order to highlight the acknowledged contributions in the field of research and development of new systems and products, software components, activities that implement new hardware systems, the balance and active control of equipments in measurement systems and complex monitoring, applications in the field of noise and fluctuations, development of research equipments.

The second chapter is dedicated to the aspects connected to researches regarding development of studies and measurements for noise and fluctuations in systems and devices with application in the development of a “nitriding thickness industrial sensor” (for use in-situ for the automatization of industrial processes), the development of new methods of investigating thin layers and nano-materials by noise and fluctuations measurements, the expansion of noise measurements to the

investigation of the reliability of electronic components (field in which, from 1996, the author work is cited as reference work of high sensibility in the investigation of LED's reliability).

Chapter 3 covers the field of virtual instrumentation in education and research, reflecting the long cooperation with National Instruments from USA, one of the most important partners in the country and abroad (from 2004, from the beginning of REV International Conference, than in 2005 by the founding of IAOE International Associations - this partnership is in permanent growth and development). The graphic language program Lab View is intensely used and offers a strong support for scientific and educational applications: the development of equipments for measuring the HALL constant, the implementation of remote control, a new cooperation with Agilent (Keysight) regarding a lab implemented in the iLab technology from MIT US, the development of system with variable magnetic field using permanent neodim magnets, the launch of a new concept of "cloud instrumentation" and the development of the first applications of IoT and the most important the introduction of a new concept - "reconfigurable hardware" from the soft, using established systems: TAG4M, Arduino si RAPERRY PI.

With the company TSXperts from US we launched and presented on REV2015 Conference in Bangkok the first „*LabVIEW Compiler for ARDUINO*” and now started the BETA test of a new „*LabVIEW compiler for RASPERRY PI*” (presented in premier in chapter 3). These ideas can well sustain the concept we launched - "reconfigurable hardware".

We need to point out the last paragraph the presents the involvement of the team in an important research project FP7: "*W2PLASTICS - Magnetig sorting and ultrasound sensor technologies for production of high purity secondary polyolefines from waste*" (ENV – 2007 - 3.1.3 – 02 nr. 212782).

Chapter 4 is dedicated to the presentation of multiple applications developed and promoted by CVTC in relation to remotely controlled engineering systems, the implementation in industrial and educational labs, the combination of classic, virtual and simulated instruments, the expansion in Europe of technologies from MIT USA and the implementation in Brasov of the first iLab (currently under implementation in „National College of Informatics Grigore Moisil” and „National College Dr. Ioan Meșota” from Brasov - CVTC being actively involved and sustaining the collaboration between schools and university). In this chapter as well are presented the important steps and concrete actions in the development of remote controllable

systems from Web explorer page without the need to install additional programs on the client workstation - results that we take pride in and that were intensely used in our new TEMPUS ICo-op (<http://www.ico-op.eu>) „*Industrial Cooperation and Creative Engineering Education based on Remote Engineering and Virtual Instrumentation*” project. In this project we were the first that succeeded to implement Web interfaces developed in LabVIEW and controlled directly in MOODLE platform. These facilities are based on LabSocket technology and one original technology developed by CVTC and does not require an software installation on the client side.

Chapter 4 closes with a synthesis of several articles and ideas we promoted in relation to the close connection between Creativity and Experiment at distance, thought in a new perspective by the unprecedented development that Internet of Things (IoT) idea has.

In the last chapter, entitled “Future academic and scientific development directions” the author seeks to catch the main tendencies in regards to:

- *Current trend in remote controlled lab developments based on the idea that IoT presents and exponential development*
- *The need for careful consideration of the way these tendencies can influence research, development and especially education*
- *We need to be aware of the development need in the concepts of “knowledge” and “applied knowledge”*
- *The need for more intense and coherent action to strengthen and develop the collaboration Industry - College education - University without which one will not be capable to satisfy the new trend in Instrumentation, Remotely Controlled Systems and, why not, IoT*