

## Scientific offer\_Radu Dobrescu



### University POLITEHNICA of Bucharest Faculty of Automatic Control and Computers

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Bucharest, ROMANIA



#### **University Professor Radu Dobrescu**

PhD coordination in "Systems Engineering"

Doctoral School of Automatic Control and Computers

University POLITEHNICA of Bucharest

#### **Contact:**

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#### **Research profile:**

Currently university professor in the Department of Automation and Industrial Informatics of the Faculty of Automatic Control and Computers, PUB. Several scientific works in three main domains: Data acquisition, processing and transmission, Networked control systems, Modeling of complex systems. Project director for around 30 research projects. New researches offer pertinent results in modeling and design of adaptive complex systems using nonstandard techniques, based on fractal analysis, chaos theory and scale-free networks and development of Information Systems based on service-oriented architectures.

From 1992 Ph.D. adviser in the field of Automatic Control (now Systems Engineering) for more than 50 Ph.D. students. So far 43 theses have been completed and sustained, and 8 theses are ongoing. As a PhD supervisor initiated research into the use of fractal techniques in various fields, and since 2002 leads monthly scientific seminar „Interdisciplinary applications of nonlinear dynamical systems theory”. Organizer and chairman for seven editions of the *International Symposium / Workshop on Interdisciplinary Approaches in Fractal Applications* (IAFA) in the period 2003-2015. The 8<sup>th</sup> edition of the IAFA workshop will be held in May 2017 (<http://www.iafa2017.aii.pub.ro/>).

#### **Scientific publications:**

40 monographs / book chapters; 80 articles in journals, around 200 papers published in volumes of international scientific events, 6 national patents.

The book "*Modeling Complexity*" published at Politehnica Press in 2008 received "Stefan Odobleja" award of the Academy of Romanian Scientists. Monograph "Complexity and

Information", published at the Romanian Academy Publishing House in 2010 won the "Grigore Moisil" award of the Romanian Academy.

**Research project** (selective list – last 10 years, led as project director):

1. Telesensorics based embedded system for monitoring and controlling parameters in systems distributed over large areas – ESTELLA, CEEEX / INFOSOC, 2006-2009
2. Simulation environment based on scale-free networks for modeling biological processes with nonlinear dynamics of evolution, IDEI / CNCSIS, 2007-2010
3. Models and morphometric techniques with applications in diagnostic imaging improvement of digestive cancers and evaluation of new therapies – IMAGO, PN2 / CNMP, 2008-2011
4. Mobilized Lifestyle with Wearables, ITEA2\_Life Wear / Eureka, FP 7, 2012-2013
5. Preparing the national system of E-Administration in Romania – SMIS, PODCA / UEFISCDI, 2014-2015

**Management positions / memberships organizations and scientific committees, editorial boards**

Member of the UPB's Scientific Bulletin Editorial Board

Member of SRAIT

Member of IFAC, Technical Committee TC 5.4

Corresponding member of the Academy of Romanian Scientists

IEEE Member since 1992 and IEEE Senior Member since 2005. President of IEEE Romania Section in 2011-2014.

**Proposed subjects for doctoral research:**

***1. Predictive models for the evolution of complex systems***

***1.1. Time-series based models to predict the apparition of extreme events***

The goal of the thesis is to describe the theoretical aspects of time series analysis and of extreme value theory, as well as of the deterministic modeling of extreme events, via continuous and discrete dynamic models. The applications include climatic, seismic and socio-economic events, along with their prediction.

***1.2. Fractal analysis and cellular automata modeling of biological growth processes***

The objective of the doctoral research is to allow fractal analysis of a model for the evolution of the frontier between a growing mass (in particular a tumor) and the environmental tissue (stroma). The theoretical ingredients of this model are mixed cellular automata, the fractal dimension of the structure generated by an automaton, the frontier fractal dimension between two mixed cellular automata and the Langton's „lambda” parameter of a cellular automaton.

***2. Optimization of Quality of Services by Monitoring Cloud Traffic***

***2.1. Combining Filtering and Statistical Methods for Anomaly Detection in Information Traffic***

The goal is to study and compare different methods for analyzing residuals, focusing on different aspects of the traffic pattern change. One focuses on instantaneous behavior, another focuses on changes in the mean of the residual process, a third on changes in the variance behavior, and a fourth examines variance changes over multiple timescales. The analysis is based on the traffic self-similarity.

## *2.2 Coping with traffic uncertainty for load balancing in cloud*

The goal is to study and compare two new different approaches which have emerged to cope with both the traffic increasing dynamism and uncertainty and the need for cost-effective solutions: Robust Routing (RR) and Dynamic Load-Balancing (DLB). RR approach copes with traffic uncertainty in an off-line preemptive fashion, computing a fixed routing configuration that is optimized for a large set of possible traffic demands. On the contrary, DLB delivers traffic among multiple fixed paths in an on-line reactive fashion, adapting to traffic variations.

## ***3. Multi-agent systems for context-aware applications development***

### *3.1. Context-Aware Control and Monitoring System with IoT and cloud support.*

The purpose of the thesis is to propose a competitive architecture of a context aware system that allow the access of agents connected in sensor networks to the IoT, starting from the evidence that such objects have data and ubiquitous web services need to access, learn and interpret this data. The proposed architecture provides the technology to connect these two. An important issue is the developing of mathematical models for the virtualization of sensor node resources in a Sensor-Cloud Interface.

### *3.2. Context-Aware Multi-Agent System for Assistive Intelligence*

The goal is the design and development of an assistive system aiming at aiding people with age or health disabilities. Its features offer support to the basic needs of both caregivers and people with decline issues, based on an user centred design approach. A very important part of the thesis corresponds to research and development of a multi-network interconnected environment, capable to include sensor networks using medical and ambient sensors and domotic actuators, multimodal interfaces and communication networks that are able to operate in home environments.