# DEPENDABLE SYSTEMS

## Contact details

<table>
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<tr>
<th>Name</th>
<th>Dependable Systems</th>
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<tr>
<td>Acronym</td>
<td>DeSy</td>
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<tr>
<td>Logo</td>
<td><img src="image" alt="DeSy Logo" /></td>
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<tr>
<td>Site</td>
<td><a href="http://desy.utcluj.ro">http://desy.utcluj.ro</a></td>
</tr>
<tr>
<td>Address</td>
<td>Technical University of Cluj-Napoca, 26-28 G. Barițiu</td>
</tr>
<tr>
<td>Faculty</td>
<td>Faculty of Automation and Computer Science</td>
</tr>
<tr>
<td>Department</td>
<td>Department of Automation</td>
</tr>
<tr>
<td>Telephone</td>
<td>+40 264 401427</td>
</tr>
<tr>
<td>Fax</td>
<td>+40 264 594835</td>
</tr>
<tr>
<td>Director</td>
<td>Prof. Dr. Eng. Liviu Miclea</td>
</tr>
<tr>
<td>e-mail</td>
<td><a href="mailto:Liviu.Miclea@aut.utcluj.ro">Liviu.Miclea@aut.utcluj.ro</a></td>
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## Areas of expertise

**Dependability, Security.**
- Development of intelligent techniques for dependability (availability, reliability, safety, integrity and maintainability), security (confidentially) and testing of information systems;
- Analysis, design, implementation and testing of information systems with dependability properties used in various fields (e.g. critical infrastructure - energy, transport, environment; medicine).

**Cyber – Physical Systems (CPSs).**
- Development of abstractions, architectures, and tools to allow implementation of reliable CPSs made from unsafe components and resistant CPSs at cyber or physical attacks;
- Development of the semantic basics for heterogeneous models composition and for modelling languages that describe various physical processes of a CPS and their associated logic.

**Intelligent Systems.**
- Analyse, design, implementation and testing of intelligent real-time control and monitoring systems using artificial intelligence techniques (intelligent agents, fuzzy logic, data mining, etc.).

## Team and key skills

**Prof. Eng. PhD Liviu Miclea** is an experienced researcher (29 years) and the founder of DeSy research group. He’s areas of teaching and research include design for testability, automatic testing, reliability and diagnosis, computer aided design, distributed systems, intelligent multi-agent systems, dependable cyber-physical systems. He coordinated several national and international research projects in the field of artificial intelligence, medical informatics, and dependable systems. He is author or co-author of 15 books, 39 research works and more than 140 scientific publications (including ISI publications).

**Prof. Eng. PhD Honoriu Vâlean** is an experienced researcher (23 years). He’s areas of teaching and research include monitoring and control systems based on software agents and advanced Internet technologies. He coordinated several national research projects in the field of artificial intelligence and medical informatics. He is author or co-author of 12 books and more than 120 scientific publications (including ISI publications).

**Assoc. Prof. Eng. PhD Enyedi Szilárd** has expertise in reliability and diagnosis, communication systems, advanced Internet technologies, multi-agent technologies, modeling and simulation. He authored or co-authored over 50 papers published in journals or conference proceedings, 3 books chapters.

**Eng. PhD Teodora Sanislav** has experience in the field of intelligent multi-agent systems, control and data acquisition systems, dependable cyber-physical systems, data mining techniques. She authored or co-authored 24 scientific papers published in journals or conferences proceedings.

Other members of the DeSy research group are: **Eng. PhD Ovidiu Stan**, **Eng. PhD Mădălîn Neagu**, **Eng. PhD Student Iulia Ștefan**, **Eng. PhD Student Laura Vegh**.

## Infrastructure

**Hardware Equipment:** R101 Server rack/Blade, Development board with microcontroller 8051, Development board with FPGA Virtex II, Development board with CPLD Spartan III, IC test board, Mobile application development platform, PDA HTC, PDA IPAQ

**Software development** frameworks for simulation and testing, computer aided design, various informatics systems development
Development strategy

The development strategy pursues the collaboration with other research groups within TUCN, as well as with national and European research institutes and universities, in order to develop interdisciplinary research projects with high impact in the scientific community and industry, funded by national programs (e.g. PN2) and international programs (e.g. bilateral cooperation, Horizon 2020, Eureka, CHIST-ERA). These projects represent the funding sources needed to improve the research infrastructure and to attract young researchers, and the collaboration framework between academia environment and industry in order to carry out research based on market requirements and to transfer the research results to industrial partners.

Representative projects


**CyCloSe**, "Designing Cloud-based Self-healing Cyber-Physical Systems", (2013-2014), Romania–Italy Bilateral Cooperation with Politecnico di Torino, aims to develop an infrastructure for designing self-healing cyber-physical systems using cloud computing technology to store, manage and compute data in a large scale context, in order to address the new dependability problems of embedded applications by means of self-healing technologies specialized for the particular application domain.


**OSMOCEL**, "Methods and Technologies based on Molecular and cellular Medicine Applied in Surgery and Treatment of Bone Cancer, Bone Metastases and Osteo-articular Lesions", (2007-2010), PN2-Partnerships, Joint Applied Research Project, funded by the Romanian Authority for Scientific Research, aimed to develop new surgical strategies (methods and techniques), based on utilization of metallic implants or prostheses and various nanobiostructures with multifunctional properties, obtained by specific methods of molecular or colloidal self assembly. [http://www.granturi.umfcluj.ro/OSMOCEL/homeen.html](http://www.granturi.umfcluj.ro/OSMOCEL/homeen.html)

**I-GLOB**, "Prediction and warning system concerning the global warming effects upon human", (2008-2011), PN2-Partnerships, Joint Applied Research Project, funded by the Romanian Authority for Scientific Research aimed to develop a prediction and warning system concerning the global warming impact related to the population health and elaborates the adequate prevention strategies. The basic relations between global warming and population health is materialized in the accomplishment of an analysis study concerning the phenomenon amplitude and the effects on the ecosystems end human factor; the current phase of global warming monitoring and prediction systems is assessed. [http://www.automation.ro/IGlob/](http://www.automation.ro/IGlob/)

**SIMONPAN**, "Intelligent System of Monitoring and Early Warning upon Pandemic Spread of Viruses", (2006-2008), CEEX, Joint Applied Research Project, funded by the Romanian Authority for Scientific Research aimed to achieve an intelligent system for early warning, monitoring and prediction of viruses evolution with pandemic spread. Based on a consistent previous documentation, including statistical data upon existence and spread of some actual viruses, the system has modern and strong databases with fast access, which will form the support of prediction development. An efficient modelling and simulation program module provide evolution prognosis for the global spread of researched viruses. The system has an efficient component of prediction and early warning, aiming the elaboration of some mechanisms to prevent the viruses spread to the areas with the highest risk. A strong set of maps, both at global level and at local level, represent the visual support to put forward warning prognosis concerning the areas with high potential of exposure. The achievement of a portal with global access containing warning messages and the pandemic spread situation on days (both previous days and the prognosis for subsequent days) are extremely useful for the public, specialists and decisional factors for their futures actions. [http://www.granturi.umfcluj.ro/simonpan/simonpan_obj_ro.html](http://www.granturi.umfcluj.ro/simonpan/simonpan_obj_ro.html)

**SISAL**, "Intelligent system for food quality detection using innovative techniques based on chemical sensors", (2005-2007), CEEX, Joint Applied Research Project, funded by the Romanian Authority for Scientific Research aimed to develop a portable device for food quality detection, using chemical sensors and learning mechanisms.
Significant results

Book Chapters, in the past 5 years:

Papers published in ISJ journals, in the past 5 years:

Papers published in indexed IDB conferences proceedings/journals, in the past 5 years:


National Patent Applications, in the past 5 years:

The offer addressed to the economic environment

<table>
<thead>
<tr>
<th>Research &amp; development in core areas</th>
<th>Abstractions definition, architectures design and tools implementation to achieve the development of highly dependable and secure CPSs;</th>
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<td>Expansion of artificial intelligence techniques in order to implement some modelling and control applications.</td>
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<tr>
<td>Research &amp; development in applied fields</td>
<td>Analysis, design, implementation and validation of dependable CPSs used in water resources management, electrical power generation and transport;</td>
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<td></td>
<td>Analysis, design, implementation and validation of information systems applied in various fields;</td>
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<td>Application of artificial intelligence techniques in energy production, medicine, food quality control.</td>
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<tr>
<td>Consulting</td>
<td>Consulting, research, design, development of dependable information systems and intelligent systems for industrial and scientific environment.</td>
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<td>Applied engineering services</td>
<td>Computer testing services;</td>
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<td>Programming and software and hardware consultancy services;</td>
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<td>Intelligent systems design and implementation services.</td>
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<td>Training</td>
<td><strong>Dependable basics</strong>: availability, reliability, safety, integrity and maintainability;</td>
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<td><strong>CPS basics</strong>: hardware and software architecture, physical devices development and programming, decision support, historical databases design and management, historical data pre- and post processing;</td>
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<td><strong>Software testing techniques</strong>: functional testing, structural testing, use of software testing frameworks;</td>
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<td><strong>Artificial intelligence techniques</strong>: intelligent agents, multi-agent systems, data mining.</td>
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Fig. 1 CPS Architecture – Cyber an middle levels (CyCloSe, “Designing Cloud-based Self-healing Cyber-Physical Systems”, 2013-2014, Romania–Italy Bilateral Cooperation with Politecnico di Torino)

Fig. 2 CPS Architecture – Physical level (CyCloSe, “Designing Cloud-based Self-healing Cyber-Physical Systems”, 2013-2014, Romania–Italy Bilateral Cooperation with Politecnico di Torino)

Fig. 3 Self-Healing System Experimental Structure (SODA, “Development of Self-Healing Capabilities for Digital Societies”, 2007-2009, PN2-Ideas, fundamental research project)

Fig. 4 DESP Model (DESP, “Electronic Healthcare Record”, 2007-2010, PN2-Partnerships, Joint Applied Research Project)