
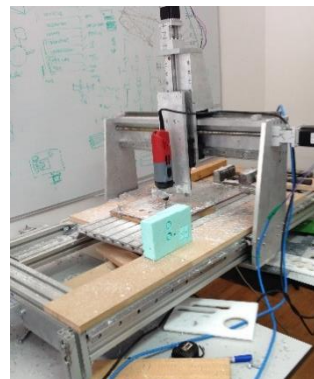


## ADVANCED MECHATRONIC SYSTEMS LABORATORY

### Contact details

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### Areas of expertise

#### Advanced Mechatronic Systems:

- **Virtual Reality:** design mechatronic systems with the assistance of virtual reality technology, which can benefit clearly from immersion and 3D. This virtual reality-based approach can be applied for the testing of intelligent mechatronic systems. Virtual reality facilitates the analysis of tests by the combination of virtual 3D models and visualization techniques.
- **Optimal design and control of parallel robots:** Parallel robots present better performances in comparison with serial robots. However, due to the strong dependence of geometric parameters and their performances, the corresponding design problems for the parallel robots are much more complex and the adequacy and effectiveness of the design method become more critical. In order to overcome this genetic algorithm optimization can be applied.
- **Haptic devices and Exoskeletons:** these mechatronic systems can be used for virtual reality and tele-presence applications. The development of even more capable devices that can accurately reproduce a large range of haptic information is an important component for the technologies of virtual reality and tele-presence. Exoskeletons can bring up a valuable contribution to the applications where the workspace is strategic.
- **Mechatronics research and training:** current research includes development of concepts, algorithms, theories, and methodologies for synergistic integration of precision mechanical engineering with advanced electronics and computer control in the design of mechatronic systems.
- **Advanced programming in MATLAB:** advanced topics like GUIs, Simulink/SimMechanics, interfaces with Arduino/Raspberry Pi control boards.

### Team

Assist. Prof. Dr. Eng. **Sergiu-Dan Stan**, Assist. Prof. Dr. Eng. Emil Teușan, Assist. Prof. Dr. Eng. Ionut Muntean

### Representative projects

**SMART. "Complex mechatronic systems for medical applications"** (2008-2011). National project, the project aimed of realization of integrated, innovative system regarding the complex mechatronic systems for medical applications.

**EXORAS. "New Haptic Arm Exoskeletons for Robotics and Automation in Space"** (2012-2015). National project, the project seeks to develop in Romania capacity building at national level and to stimulate Romania's participation to international space missions and programs – in particular ESA, in the field of Robotic Exploration. The impact will be to develop new haptic arm exoskeleton to enable in-space force-feedback telemanipulation with redundant robotic arms, and so help enable new policies in Romania such as robotic exploration, as well as supporting Romania towards increased participation to ESA programs.

**CLEM. "CLOUD services for E-learning in Mechatronics technology"** (2012-2013). European project, Leonardo da Vinci Development of Innovation type, the CLEM project is the first step to fulfil the vision of establishing "a global Mechatronics technology in VET knowledge repository for exchange and sharing". So, the aims of this project is to design and develop an infrastructure for e-Learning that can continue training of VET teachers in Mechatronics

technology and a systematic framework that VET teaching and training systems and materials can be streamlined and shared. Consequently, the VET teachers and trainers can gain efficient and effective supports in obtaining the knowledge, designing and preparing their courses and teaching materials, and cooperating with colleagues over Internet via cloud services.

**GREENet. "Globally Recoverable and Eco-friendly E-equipment Network with Distributed Information Service Management"** (2011-2014). European FP7 project, aimed to establish closer international cooperation and to share and develop research on globally sustainable Waste Electrical and Electronic Equipment (WEEE) management is timely and significant. This GREENet project is aimed at teaming up multi-disciplinary research teams from the EU and China to enhance the knowledge base and achieve research synergies as integrated technical solutions in the relevant areas.

## Significant results

### The most representative publications of the past 5 years:

1. Racz, AA, Muntean, I., Stan, SD, A look into electric/hybrid cars from an ecological perspective, 8TH INTERNATIONAL CONFERENCE INTERDISCIPLINARITY IN ENGINEERING, INTER-ENG 2014 Book Series: Procedia Technology Volume: 19 Pages: 438-443 Published: 2015
2. Busu, Alexandra Antonia; Muntean, Ionut; Stan, Sergiu-Dan, An analysis of the current challenges of WEEE remanufacturing, 8TH INTERNATIONAL CONFERENCE INTERDISCIPLINARITY IN ENGINEERING, INTER-ENG 2014 Book Series: Procedia Technology Volume: 19 Pages: 444-450 Published: 2015
3. Bijan Ranjbar Sahraei, Faridooon Shabaninia, Alireza Goudarzi Nemati, Sergiu-Dan Stan, "A Novel Robust Decentralized Adaptive Fuzzy Control for Swarm Formation of Multiagent Systems". *IEEE Transactions on Industrial Electronics* 59(8): 3124-3134 (2012).
4. N. R. Rat, M. Neagoe, D. Diaconescu, S. D. Stan, "Dynamic simulations regarding the influence of the load-rigidity correlation on the working accuracy of a medical Triglide parallel robot", ISSN 1392 – 1207, *MECHANIKA*, 2011, 17(2): pp. 178-181.
5. D. Verdes, S.D. Stan, et al., "Study of design, kinematics and virtual control of 4 degrees of freedom parallel robot", ISSN 1392 – 1207, *MECHANIKA*, 2010. Nr.2(82), pp. 70-74.
6. S.D. Stan, et al., "Kinematics and fuzzy control of ISOGLIDE3 medical parallel robot", *Journal MECHANIKA*, No.1(75), pp. 62-66, 2009, ISSN 1392 - 1207.
7. C. Szep, S.D. Stan, et al., "Study of design, kinematics and accuracy modelling of 3 degrees of freedom robot", ISSN 1392 – 1207, *MECHANIKA*, 2009. Nr.3(77), pp. 58-61.
8. M. Bara, S.D. Stan, et al., "Design and virtual reality simulation of frontal - sinusoidal ball transmission", ISSN 1392 – 1207, *MECHANIKA*, 2009. Nr.4(78), pp. 63-68.
9. S.D. Stan, M. Manic, et al., "Evolutionary Approach to Optimal Design of 3 DOF Translation Exoskeleton and Medical Parallel Robots"; HSI 2008, *IEEE Conference on Human System Interaction*, Krakow, Poland, May 25-27, 2008.
10. S.D. Stan, M. Manic, et al., "Kinematics Analysis, Design, and Control of an Isoglide3 Parallel Robot (IG3PR)", *IECON08, The 34th Annual Conference of the IEEE Industrial Electronics Society*, Orlando, Florida, pp.2636-2641, Nov. 10-13, 2008.
11. S.D. Stan, M. Manic, et al., "A Novel Virtual Reality Robot Interface for Isoglide3 Parallel Robot" , *Lecture Notes in Computer Science* , (LNCS)/Springer, C. Xiong et al. (Eds.): *ICIRA 2008*, Part I, LNAI 5314, pp. 1265–1275, © Springer-Verlag Berlin Heidelberg 2008.
12. S.D. Stan, et al., "Modelling, design and control of 3DOF medical parallel robot", *Journal MECHANIKA*, No. 6(74), pag. 68-71, 2008, ISSN 1392 - 1207.

### Products and technologies

1. Real-time control of mechatronic systems
2. Optimal design of parallel robots using genetic algorithms

## The offer addressed to the economic environment

<b>Research &amp; development</b>	Development of solutions for modelling mechatronic systems. Development of original algorithms for optimization with genetic algorithms of mechatronic systems. Development of solutions for control of CNC machines/ robot systems
<b>Consulting</b>	Consulting, design, research and prototyping of mechatronic systems
<b>Applied engineering services</b>	Custom solutions for specific issues regarding the implementation of mechatronic systems
<b>Training</b>	<b>Matlab programming:</b> getting started with Matlab, m-files, Graphical User Interfaces, Virtual Reality, Simulink/SimMechanics Toolbox..etc. <b>Optimal design with Genetic Algorithms:</b> optimization, genetic algorithms, Pareto optimal front, multicriteria optimization. <b>Arduino:</b> hardware, breadboards and prototyping, simple electronic components, Introduction to important programming concepts, software interface with Matlab.