## RESEARCH CENTER FOR INDUSTRIAL ROBOTS SIMULATION AND TESTING

**Contact details**

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| Name | **Research Center for Industrial Robots Simulation and Testing** |
| Acronym | **CESTER** |
| Logo | CESTER<br>RESEARCH CENTER FOR INDUSTRIAL ROBOTS SIMULATION AND TESTING |
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**Areas of expertise**

Innovative development of intelligent robotic systems with complex structures, focused on parallel architectures
Intelligent medical robots: development of application based intelligent robotic systems and instrumentation for minimally invasive surgery, targeted diagnosis and treatment of cancer tumors, rehabilitation of patient with neuromotor deficiencies.
Advanced adaptive control solutions, including tele-robotics
Virtual and augmented reality and development of algorithms based on Artificial Intelligence solutions
Modeling and Simulation technologies of complex systems

**Team**

**Senior researchers:** Prof. Doina Pisla; Prof. Nicolae Plitea; Prof. Adrian Pisla; Prof. Calin Vaida; Prof. Dan Opruta; Prof. Tiberiu Antal; Assoc. Prof. Bogdan Gherman; Assoc. Prof. Ovidiu Detesan
**Postdoctoral researchers**: Florin Covaciu, PhD; Paul Tucan, PhD; Eng. Iuliu Nadas, PhD; Eng. Nicoleta Pop, PhD
**Doctoral researchers**: Alin Burz; Ionut Ulinici; Alexandru Banica; Alexandru Pusca; Gabriela Rus; Jefte Nagy; Alin Horsia; Remus Crisan; Bianca Baldean; Gabriel Todea; Ionut Zima
**Master students**: Eng. Daniel Horvath; Eng. Stefan Iakab; Eng. Andrei Cailean

**Representative projects**

**APOLLO**, "**Intelligent tele-robotic systems for the personalised treatment of neuromotor deficit to increase the patients quality of life**", PTI-2022 (Technologic Transfer), MySMIS code 155988, (2023)
**MAN-X**, "**Exoskeleton structure for human augmentation**", 1-PSCD/2022, (2022-2025)
**CHALLENGE**, "**New frontiers in robotic assisted single port surgery: a novel robotic system with dexterous instruments**", Code PN-III-P4-ID-PCE-2020-0572-PCE-171, (2021-2023)
**Enhance**, "**Innovative safe robotic system for enhanced patient-centered treatment of liver cancers**", Code PN-III-P2-2.1-PED2021-2790, (2022-2024)
**Hope2Walk**, "**An innovative modular rehabilitation robot for the efficient therapy of lower limb motor deficit**", Code: PN-III-P2-2.1-PED2021-3430, (2022-2024)
**Wisdom of Age**, "**A Seniors Digital Platform for Knowledge Transfer towards Industrial Companies**", Code AAL-2020-7-83-CP, (2021-2023)
**IMPROVE, "Innovative approach precision on robotic assisted surgical treatment of liver tumors based on integrated diagnostic imaging molecular"**, Code PN-III-P1-1.2-PCCDI 2018, (2018-2020)
**AGEWELL, "Innovative approaches rehabilitation and Asssistive Robotics for Healthy Ageing"**, POC project ID 37_215, MySMIS code 103415, (2016-2020)
**INNOHEALTH, "An innovative robotic system for upper limb rehabilitation",** RIS 2019 Innovation Call, 21540/07.08.2019, EIT Health (2019)
**TASUK,** "**Manipulation Systems for Sample Handling in a Sample Receiving Facility**", TASUK/16/11305/NBO/1424, ESA European Space Agency (2015-2020)
**ROBOCORE, "Robotic assisted prostate biopsy, a high accuracy innovative method"**, Code PN-II-PT-PCCA-2013-4-0647 (2014-2017)
**ACCURATE, "A multi-purpose needle insertion device for the diagnosis and treatment of cancer"**, Code PN-II-RU-TE- 2014-4-0992, (2015-2017)

**Significant results**

**The most representative publications of the past 5 years (10 selected papers):**

1. Tohanean, N.; Tucan, P.; Vanta, O.-M.; Abrudan, C.; Pintea, S.; Gherman, B.; Burz, A.; Banica, A.; Vaida, C.; Neguran, D.A.; Ordog, A.; Tarnita, D.; Pisla, D. The Efficacity of the NeuroAssist Robotic System for Motor Rehabilitation of the Upper Limb—Promising Results from a Pilot Study. J. Clin. Med, 12, 425, 2023, (IF: 5.583)
2. Tucan, P.; Vaida, C.; Horvath, D.; Caprariu, A.; Burz, A.; Gherman, B.; Iakab, S.; Pisla, D. (c.a.) Design and Experimental Setup of a Robotic Medical Instrument for Brachytherapy in Non-Resectable Liver Tumors. Cancers 2022, 14, 5841, 2022, (IF: 6.575)
3. Graur, F.; Ciocan, R.A.; Ciocan, A.; Puia, I.C.; Mois, E.; Furcea, L.; Zaharie, F.; Popa, C.; Schlanger, D.; Vaida, C.; Pisla, D.; Al Hajjar, N. Trends in Minimally Invasive Approaches for Liver Resections–A Systematic Review. J. Clin. Med. 2022, 11, 6721, 2022, (IF: 4.964)
4. Pisla, D., Birlescu, I., Pusca, A., Tucan, P., Gherman, B., Vaida, C., Kinematics and Workspace Analysis of an Innovative 6-Dof Parallel Robot for SILS, Proc. of the Rom. Acad., Series A, 23(3), pp.277-286, 2022, (IF: 0.734)
5. Pisla, D.; Birlescu, I.; Crisan, N.; Pusca, A.; Andras, I.; Tucan, P.; Radu, C.; Gherman, B.; Vaida, C. Singularity Analysis and Geometric Optimization of a 6-DOF Parallel Robot for SILS. Machines 2022, 10, 764, (IF: 2.899)
6. Tucan, P.; Vaida, C.; Ulinici, I.; Banica, A.; Burz, A.; Pop, N.; Birlescu, I.; Gherman, B.; Plitea, N.; Antal, T.; Carbone, G.; Pisla, D. Optimization of the ASPIRE Spherical Parallel Rehabilitation Robot Based on Its Clinical Evaluation. Int. J. Environ. Res. Public Health 2021, 18, 3281. (IF 4.614)
7. Major, Z.Z.; Vaida, C.; Major, K.A.; Tucan, P.; Brusturean, E.; Gherman, B.; Birlescu, I.; Craciunaș, R.; Ulinici, I.; Simori, G.; Banica, A.; Pop, N.; Burz, A.; Carbone, G.; Pisla, D. Comparative Assessment of Robotic versus Classical Physical Therapy Using Muscle Strength and Ranges of Motion Testing in Neurological Diseases. J. Pers. Med. 2021, 11, 953, 2021, (IF: 3.508)
8. Radu, C.; Fisher, P.; Mitrea, D.; Birlescu, I.; Marita, T.; Vancea, F.; Florian, V.; Tefas, C.; Badea, R.; Ștefănescu, H.; Nedevschi, S.; Pisla, D.; Hajjar, N.A. Integration of Real-Time Image Fusion in the Robotic-Assisted Treatment of Hepatocellular Carcinoma. Biology 2020, 9, 397, 2020, (IF: 5.079)
9. Vaida, C., Birlescu, I., Pisla, A., Ulinici I., Tarnita, D., Carbone, G., Pisla, D., "Systematic Design of a Parallel RoboticSystem for Lower Limb Rehabilitation", IEEE ACCESS, vol. 8, 34522(15), 2020 (IF: 4.098)
10. Husty, M., Birlescu, I., Tucan, P., Vaida, C., & Pisla, D. An algebraic parameterization approach for parallel robots analysis. Mechanism and Machine Theory, 140, 245–257, 2019, (IF: 4.93)

**Patents:**

1. Pisla, D., Birlescu, I., Vaida, C., Gherman, B., Tucan, P., Carbone, G., Plitea, N.: Parallel robot for lower limb rehabilitation, Decision No. 4.3/163 from 28/05/2021
2. Pisla D., Gherman B., Nadas I., Pop N., Craciun F., Tucan P., Vaida C., Carbone G.: Innovative paralel robot for lower limb rehabilitation, Decision No. 4.3/164 from 28/05/2021
3. Vaida, C., Plitea, N., Pisla, D., Carbone, G., Gherman, B., Ulinici, I., Pisla, A., Spherical robot for medical rehabilitation of proximal area of upper limb, RO-132233 (2020)
4. Gherman, B., Pisla, D., Plitea, N., Vaida, C., Carbone, G., Pisla A., Parallel robotic system for medical rehabilitation of upper limb, RO-132234 (2020)
5. Vaida, C., Plitea, N., Pîslă, D., Gherman, B., Suciu, M., "Orientation module with multiple curvatures", Patent RO 129923 B1 (2019)
6. Plitea, N., Pisla, D., Vaida, C., Gherman, B., „Surgical Robot", Patent RO 126271 (2012)

**Significant products:**

1. Intelligent medical parallel robot for lower limb rehabilitation - RECOVER, 2022
2. Innovative safe robotic system for enhanced patient-centered treatment of liver cancers – PROHEP-LCT, 2020
3. Intelligent medical parallel robot for lower limb spatial rehabilitation – RAISE, 2020
4. Intelligent medical parallel robot for upper limb rehabilitation – ASPIRE, 2019 (validated clinically in two hospitals)
5. Intelligent medical parallel robot for upper limb rehabilitation – PAREEX, 2019
6. Intelligent medical parallel robot for transperineal prostate biopsy – ROI-PROS1, 2015

**The offer addressed to the economic environment**

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| Research & development | **Medical Robotics**<br>Development, testing validation and technological transfer of intelligent, application oriented robotic systems and instrumentation<br>**Adaptive control solutions including AR/VR/AI integration**<br>Development of intelligent control solutions, including human-centered approaches and multi-modal<br>**Precision Robotics and Micro-robotics**<br>The development of innovative solutions for parallel robots, micro-robots and reconfigurable structures with parallel architecture for industrial applications interactive interfaces<br>**Mechanisms synthesis**<br>Advanced studies in the field of synthesis of new conceptual models of mechanisms with complex structure, focused on parallel architectures, modelling, design, digital twin validation, numeric and generative design optimizations |
| Consulting | **Product Lifecycle Management.** Consultancy in product and process development using competitive tools and the new concepts of Design for X, IoT, Digital Twin<br>**High power drives.** Consultancy in development of custom-made high-power drives and applications<br>**Renewable energies.** Consultancy in the design of custom-made solutions for energy harvesting |
| Training | Through its training center, CESTER offers those interested in advanced training Solid Edge and Siemens NX courses as well as basic courses in control systems with the B & R Automation Platform |

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