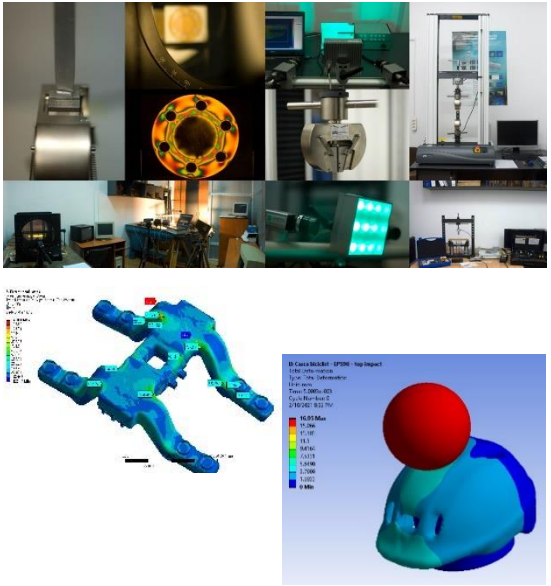



EXPERIMENTAL AND COMPUTATIONAL SOLID MECHANICS LABORATORY

Contact details

Name	Experimental and Computational Solid Mechanics Laboratory	
Acronym	ECSML	
Logo		
Site	https://eeris.eu/erif-2000-000j-1533	
Address	B-dul Muncii 103-105, Cluj-Napoca, C03	
Faculty Department	Faculty of Automotive, Mechatronics and Mechanical Engineering Department of Mechanical Engineering	
Telephone	0264-401663	
Fax	0264-414490	
Director	Prof.PhD Habil. Mircea Cristian DUDESCU	
e-mail	mircea.dudescu@rezi.utcluj.ro	

Areas of expertise

Mechanical Characterization of Materials: -Determination of mechanical and thermo-mechanical characteristics of materials using standard testing and equipment for metals, plastics, thermo-plastics, composites, additive manufacturing materials etc.

Experimental Stress and Deformation Analysis: - Experimental determination of stress and deformation of structures using the Strain Gauge Technique and/or optical methods like 2D and 3D DIC (Digital Image Correlation), Moire, Photoelasticity and ESPI (Electronic Speckle Pattern Interferometry)

Thermo-Mechanical Simulation using Finite Element Analysis: -Stress-strain analysis and deformation determination using ANSYS Workbench finite element analysis software for parts and assemblies under mechanical and/or thermal loads

3D Metrology: -3D scanning with the GOM Atos Core stereo camera measuring system with Blue Light Technology; GD&T report generation in reference to CAD and/or technical drawings using the GOM Inspect software

Team

Prof.PhD Habil. Mircea Cristian DUDESCU, Prof.PhD Habil. Mihaela SUCIU, Lect. PhD Adrian BOTEAN, Lect.PhD Radu CHIOREAN, Lect.PhD Mihaela SIMION, Lect.PhD Ioana RAD, Assistant PhD Cristian VILAU, PhD Stud. Laszlo RACZ, PhD. Stud. Eng. Adrian MURESANU, PhD. Stud. Eng. Theodor ZACH, PhD. Stud. Eng. Vasilica CIMPOIES

Representative projects

Coordinated projects

- ✓ Transilvania Digital Innovation Hub, project no. 1_EDIH/23.11.2023, MySMIS: 161789, industrial partner Napochim SA, Cluj-Napoca, 2024-2025.
- ✓ Smart buildings adaptable to the effects of climate change (CIA_CLIM), Complex Project carried out in RDI consortia (PCCDI30), coordinator UP Timișoara, 2018-2021/ P1 partner project management at UTC-N.
- ✓ Development of a special industrial machine for winding heavy-duty rotors, 2016-2017, Selenco Service SRL
- ✓ Thermolectric actuation of structures specific to MEMS devices, 2024-2025, GNaC2023 ARUT.

Members of the research teams

- ✓ Research, design and development of environmentally friendly electric vehicles made of advanced composite materials, equipped with photovoltaic panels and construction of an assembly line in order to obtain the final product, 2021-2023, N-C-ST-202, National Technological Services Contract (N-C-ST) with Belco Avia
- ✓ New cement-based nanocomposite materials usable in 3D printing (CBN3D), PN-III-P4-4.1. ID-PCE 2021, 2021-2023,
- ✓ Advanced technologies for smart urban electric vehicles – URBIVEL, ID P_40_333, MySMIS: 105565, project funded by the European Regional Development Fund through the Competitiveness Operational Programme, 2018–2021 / member of the research team under subsidiary contracts no. 5 with the title "Research on a new concept of light suburban electric train", between UTC-N and SC REMARUL 16 FEBRUARIE SA (industrial partner) and no.7 with the title "Design of the mechanical structure of a two-seater urban electric vehicle using advanced composite materials", between UTC-N and S.C. Belco Avia SRL.
- ✓ Optimization of fiber-reinforced polymer composite materials and manufacturing technology used in the construction of body elements for electric vehicles, Bridge Grant Project (Knowledge Transfer to the Economic

Agent), PN-III-P2-2.1-BG-20160210, 2016-2018

- ✓ Optimization of 3D printing for customized dental applications (OpTi-DeP), Bridge Grant Project (Knowledge Transfer to the Economic Agent), 101BG/2016 (PN3/P2/108/01.11.2016), 2016-2018
- ✓ Development and testing of a new type of concrete with increased bending strength obtained by adding nanoparticles and organosilane, Experimental Demonstrative Project PN-III-P2-2.1-PED-125/ 2017-2018
- ✓ Fabrication of a Robust Metal Contact MEMS Switch (RoMEC), Experimental Demonstrative Project PN-III-P2-2.1-PED-33/ 2017-2018

Significant results

Articles in ISI rated journals, in the past 5 years:

- ✓ Zach, T. F., Dudescu, M. C. (2024). The Three-Dimensional Printing of Composites: A Review of the Finite Element/Finite Volume Modelling of the Process. *Journal of Composites Science*, 8(4), 146. <https://doi.org/10.3390/jcs8040146>
- ✓ Muresanu, A. D., & Dudescu, M. C. (2024). Modelling of a Cylindrical Battery Mechanical Behavior under Compression Load. *Batteries*, 10(10), 353. <https://doi.org/10.3390/batteries10100353>
- ✓ Cimpoies, V. I., Dudescu, M. C. (2024). Numerical and Experimental Analysis of Quilling-Inspired Metamaterials. *Procedia Structural Integrity*, 56, 49-57. <https://doi.org/10.1016/j.prostr.2024.02.036>
- ✓ Racz, L., Dudescu, M. C. (2024). Numerical evaluation of the infill pattern upon mechanical proprieties of 3D printed materials. *Procedia Structural Integrity*, 56, 3-10. <https://doi.org/10.1016/j.prostr.2024.02.030>
- ✓ Chiorean, R., Vilău, C., Simion, M., Paul, BERE., Neamțu, C., & Dudescu, M. C. (2023). Stiffness Analysis of Electric Car Composite Bumpers. *Acta Technica Napocensis-Series: Applied Mathematics, Mechanics, and Engineering*, 66(1s).
- ✓ Simion, M., Vilău, C., Chiorean, R., Paul, Bere, Neamțu, C., & Dudescu, C. (2023). Study Of the Mechanical Behavior of a Tailgate Made of Carbon Fiber Composite Material. *Acta Technica Napocensis-Series: Applied Mathematics, Mechanics, And Engineering*, 66(3).
- ✓ Birleanu, C., Pustan, M., Cioaza, M., Bere, P., Contiu, G., Dudescu, M. C., & Filip, D. (2023). Tribo-Mechanical Investigation of Glass Fiber Reinforced Polymer Composites under Dry Conditions. *Polymers*, 15(12), 2733. <https://doi.org/10.3390/polym15122733>
- ✓ Dinte, E., Muntean, D. M., Andrei, V., Boșca, B. A., Dudescu, C. M., Barbu-Tudoran, L., ... & Ilea, A. (2023). In Vitro and In Vivo Characterisation of a Mucoadhesive Buccal Film Loaded with Doxycycline Hyclate for Topical Application in Periodontitis. *Pharmaceutics*, 15(2), 580. <https://doi.org/10.3390/pharmaceutics15020580>
- ✓ Rusu, M. M., Vilau, C., Dudescu, C., Pascuta, P., Popa, F., & Ardelean, I. (2023). Characterization of the Influence of an Accelerator upon the Porosity and Strength of Cement Paste by Nuclear Magnetic Resonance (NMR) Relaxometry. *Analytical Letters*, 56(2), 303-311. <https://doi.org/10.1080/00032719.2022.2072855>
- ✓ Dudescu, M. C., Racz, L., & Popa, F. (2023). Effect of infill pattern on fatigue characteristics of 3D printed polymers. *Materials Today: Proceedings*, 78, 263-269. <https://doi.org/10.1016/j.matpr.2022.11.283>
- ✓ Rusu, M. M., Vulpoi, A., Vilau, C., Dudescu, C. M., Pășcuță, P., & Ardelean, I. (2022). Analyzing the Effects of calcium nitrate over white Portland Cement: A multi-Scale approach. *Materials*, 16(1), 371. <https://doi.org/10.3390/ma16010371>
- ✓ Platon, M. A., Nemeș, O., Tiuc, A. E., Vilău, C., Dudescu, C. M., & Pădurețu, S. (2022). The Influence of Process Parameters on the Mechanical Behavior of a Composite Material Made from Mixed Plastic Wastes. *Archives of Metallurgy and Materials*, 1235-1241. <https://doi.org/10.24425/amm.2022.141047>
- ✓ Cimpean, S. I., Burtea, A. L. C., Chiorean, R. S., Dudescu, M. C., Antoniac, A., Robu, A., ... & Timis, L. I. (2022). Evaluation of Bond Strength of Four Different Root Canal Sealers. *Materials*, 15(14), 4966. <https://doi.org/10.3390/ma15144966>
- ✓ Pop, S. I., Dudescu, M., Mihali, S. G., Păcurar, M., & Bratu, D. C. (2022). Effects of Disinfection and Steam Sterilization on the Mechanical Properties of 3D SLA-and DLP-Printed Surgical Guides for Orthodontic Implant Placement. *Polymers*, 14(10), 2107. <https://doi.org/10.3390/polym14102107>
- ✓ Muresanu, A. D., & Dudescu, M. C. (2022). Numerical and Experimental Evaluation of a Battery Cell under Impact Load. *Batteries*, 8(5), 48. <https://doi.org/10.3390/batteries8050048>
- ✓ Racz, L., & Dudescu, M. C. (2022). Numerical Investigation of the Infill Rate upon Mechanical Proprieties of 3D-Printed Materials. *Polymers*, 14(10), 2022. <https://doi.org/10.3390/polym14102022>
- ✓ Rusu, M. M., Vilau, C., Dudescu, C., Pascuta, P., Popa, F., & Ardelean, I. (2022). Characterization of the Influence of an Accelerator upon the Porosity and Strength of Cement Paste by Nuclear Magnetic Resonance (NMR) Relaxometry. *Analytical Letters*, 1-9. <https://doi.org/10.1080/00032719.2022.2072855>
- ✓ Bodea, I. M., Cătunescu, G. M., Pop, C. R., Fiț, N. I., David, A. P., Dudescu, M. C., ... & Beteg, F. I. (2022). Antimicrobial Properties of Bacterial Cellulose Films Enriched with Bioactive Herbal Extracts Obtained by Microwave-Assisted Extraction. *Polymers*, 14(7), 1435. <https://doi.org/10.3390/polym14071435>
- ✓ Vilau, C., Dudescu, M.C. (2021): Impact Behaviour of Expanded Polystyrene By Experimental And Numerical Methods. *Acta Technica Napocensis - Series: Applied Mathematics, Mechanics, And Engineering*, 64(2), ISSN 2393–2988.
- ✓ Bodea IM, Beteg FI, Pop CR, David AP, Dudescu M.C, Vilău C, Stănilă A, Rotar AM, Cătunescu GM. (2021) Optimization of Moist and Oven-Dried Bacterial Cellulose Production for Functional Properties. *Polymers* 2021, 13, 2088. *Polymers*. 13(21): 3821. <https://doi.org/10.3390/polym13213821>
- ✓ Leordean D, Vilău C, Dudescu M.C. (2021): Generation of Computational 3D Models of Human Bones Based on STL Data and CAD Software Packages. *Applied Sciences*. 11(17):7964. <https://doi.org/10.3390/app11177964>
- ✓ Bere, P., Dudescu, M., Neamțu, C., Cocian, C. (2021): Design, Manufacturing and Test of CFRP Front Hood Concepts for a Light-Weight Vehicle. *Polymers* 13(9): 1374. <https://doi.org/10.3390/polym13091374>

- ✓ Serdean, F., Pustan, M., Dudescu, C., Birleanu, C., & Serdean, M. (2020): Analysis of the Thermoelastic Damping Effect in Electrostatically Actuated MEMS Resonators. *Mathematics*, 8(7), 1124. DOI: 10.3390/math8071124
- ✓ Vilau, C., & Dudescu, M. C. (2020): Investigation of Mechanical Behaviour of Expanded Polystyrene Under Compressive and Bending Loadings, *Materiale Plastice*, 57 (2), pp. 199-207. <https://doi.org/10.37358/MP.20.2.5366>
- ✓ Chiorean, R. S., Dudescu, M. C., Neamtu, C. G., Bere, P. & Fartan, M. (2020): Design considerations for a modern tram bogie: from sheet metal to multi-layer carbon fiber reinforced composite material. *ACTA TECHNICA NAPOCENSIS-Series: APPLIED MATHEMATICS, MECHANICS, and ENGINEERING*, 63(2).
- ✓ Cimpean, S.I., Pop-Ciutrita, I., Buduru, S., Pavel, L., Florea, D.F., Delean, A.G., Moldovan, M., Dudescu, M.C., Berbec, S., Voinescu, D.C., Beznea, A., Negucioiu, M., Stefanescu, V. (2020). Assessing Fracture Resistance of non Vital Teeth Using Two Different Composite Systems: Short-Fibre-Reinforced Composite and Glass Fibre Post with Microfilled Hybrid Composite. *MATERIALE PLASTICE*, 57(4), 286-296. <https://doi.org/10.37358/MP.20.4.5427>
- ✓ Simion, M., Dudescu, C., Bere, P. & Cocean, C. (2019). Material parameters identification of carbon fibres composites with strain gauges. *ACTA TECHNICA NAPOCENSIS-Series: APPLIED MATHEMATICS, MECHANICS, and ENGINEERING*, 62(3).
- ✓ Ilea, A., Butnaru, A., Sfrângeu, S.A., Hedesiu, Dudescu, M.C., et al. (2019): Temporal bone trauma effects on auditory anatomical structures in mastoid obliteration. *European Archives of Oto-Rhino-Laryngology* 276, 513–520 (2019). <https://doi.org/10.1007/s00405-018-5227-6>
- ✓ Bere, P., Dudescu, M., Neamtu, C., Nemes, O., Moldovan, C., and Simion, M. (2019): Fabrication and Mechanical Characterization of Short Fiber-Glass Epoxy Composites, *Materials Performance and Characterization*, Vol. 8, No. 1, pp. 163-174, <https://doi.org/10.1520/MPC20180171>.
- ✓ Bacali, C., Badea, M., Moldovan, M., Sarosi, C., Nastase, V., Baldea, I., Chiorean, R.S. and Constantiniuc, M., (2019): The influence of graphene in improvement of physico-mechanical properties in PMMA denture base resins. *Materials*, 12(14), p.2335, <https://www.mdpi.com/1996-1944/12/14/2335>
- ✓ Petrișor S.M., Simion M., Example of good practices regarding the organological construction of a robotized technological product for humanitarian engineering operations, *Acta Technica Napocensis, Series: Applied Mathematics, Mechanics and Engineering*, Volume: 64 Issue: 3, Pages: 395-402, ISSN 1221-5872, 2021, WOS: 000729656100006
- ✓ Cosma Cosmin, Moldovan Mărioara, Simion Mihaela, Balc Nicolae, "Impact of laser parameters on additively manufactured cobalt-chromium restorations", *Journal of Prosthetic Dentistry*, vol. 128 (3), pp. 421-429, 2022., Print ISSN: 0022-3913, WOS: 000869716200019, <https://doi.org/10.1016/j.prosdent.2020.11.043>
- ✓ Cosma C, Teusan C, Gogola P, Simion M, Gabalcova Z, Trif A, Berce P, Balc N., Investigation of the Interface between Laser-Melted CoCr and a Stainless Steel Substrate, *Journal: Metals*, 12(6), pp. 965., 2022, Online ISSN: 2075-4701, WOS:000892145100001, <https://doi.org/10.3390/met12060965>

The offer addressed to the economic environment

Research & development	<ul style="list-style-type: none"> ✓ Mechanical characterization of materials – plastics and thermo-plastics, composites, additive manufacturing materials and structures, bacterial cellulose, dentistry fillers, adhesives and implants, coatings and micro-protective films for glass and lenses, foams for thermal insulation etc. ✓ Biomedical applications – implants, prostheses and equipment for rehabilitation, orthodontic wires & brackets, retention force measurement in facial paresis, suture strength etc. ✓ Experimental Stress Determination, Structural Stress and Deformation Measurement and Design cooperation with Industrial Partners
Consulting and access to research infrastructure	<ul style="list-style-type: none"> ✓ Consulting, design, and research in the field of experimental and computational mechanics of solids and finite element simulations. ✓ Access to test laboratories with equipment for mechanical characterization of materials and various demonstrators of measuring systems based on different principles (both contact and optical) ✓ Static and dynamic testing equipment for mechanical characterization of materials – Young's Modulus, Poisson's Ratio, Yield and Ultimate Tensile Stress, Fatigue Testing, Impact Testing (Charpy), Micro-Hardness, Torsion. ✓ Equipment for 2D and 3D Digital Image Correlation, Fringe Projection, Photoelasticity, Electronic Speckle Pattern Interferometry, Stain Gauge Technique.
Training	<ul style="list-style-type: none"> ✓ Basic design considerations for mechanical structures: yield and allowable stress, elasticity, load cases, geometrical characteristics of cross sections, optimization for efficient material usage, stability, rigidity and/or durability (cyclic loading). ✓ Using sensors and other experimental equipment for monitoring the mechanical behavior (stress level, deflection etc.) of structures and/or validating numerical models. ✓ Performing standalone static, dynamic, modal, buckling, thermal and/or coupled analysis on structures using the finite element method. ✓ Measurement and inspection of geometrical parameters and/or tolerances of parts and assemblies using fringe projection (3D Scanning)