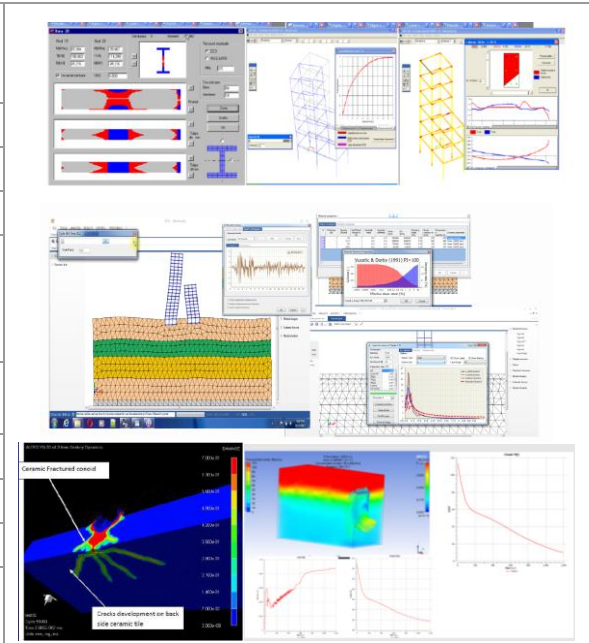


COMPUTATIONAL MODELING AND ADVANCED SIMULATION IN STRUCTURAL AND GEOTECHNICAL ENGINEERING

Contact details

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Areas of expertise

Domain: Civil Engineering-Structural and Geotechnical Engineering

Computational and experimental techniques with emphasis on the development and application of advanced nonlinear analysis of structural limit states, progressive collapse analysis of structures, push-over analysis for seismic performance evaluation of structures, analysis of structures subjected to wind actions, finite element simulation of composite materials subjected to extreme loads such as ballistic impact and explosions, design and behaviour of composite steel-concrete structures, and application of FEM for geotechnical problems and multiphysics problems. Advanced Computational Fluid Dynamics (CFD) models to identify the mechanisms of radon accumulation and developing techniques for reducing radon accumulation in homes. The stability of thin-walled members by using the Generalised Beam Theory. The stiffness evaluation of the vertical and horizontal joints between precast RC walls. The structural health monitoring of bridges by Machine Learning algorithms trained on experimental and FE numerical data.

Team (Selection)

Prof. Cosmin G Chiorean, Dr. Mihai Nedelcu, Dr. Marius Botos, Dr. Marius Buru, Dr. Mircea Botez, Dr. Ioana Marchis, Dr. Ovidiu Prodan, Dr. Milchis Tudor, Dr. Bianca Parv, Dr. Ioana Tomascu, Dr. Zsongor Gobesz, Dr. Teodora Besoiu, Dr. Tudor Petrina, Dr. Roxana Balc, Dr. Horatiu Mociran, Dr. Cristian Mojolic, Dr. HL Cucu, Dr. Anca Popa. *Phd Students:* Alin Mihali, Marius Moldovan, Vasile Chiorean, Lavinia Cucu, Mihai Selariu, Dan Miclausoiu, Mihai Bud, Bogdan Deac.

Representative projects

Smart Systems for Public Safety through Control and Mitigation of Residential Radon linked with Energy Efficiency Optimization of Buildings in Romanian Major Urban Agglomerations Code: SMART-RAD-EN:2017-2020-A1-A1; POC-A1-A1.1.4-E-2015 (<http://www.smartradon.ro/>)
Integrated design, earthquake check and shelf structures offer, Code: PN-III-P2-2.1-CI-2017-0113, http://users.utcluj.ro/~mnedelcu/Proiect%20de%20cercetare_15CI.htm
Technology for measuring forces in tensile cables, Code: PN-III-P2-2.1-CI-2017-0116, http://users.utcluj.ro/~mnedelcu/Proiect%20de%20cercetare_29CI.htm
Design and seismic performance evaluation of 3D frame structures using advanced nonlinear static analysis method (granted by [CNCCSIS](http://www.cnccsis.ro/), PNII-IDEI 193/2008)- <http://www.cosminchiorean.com/projects.html>

Significant results

The most representative publications of the past 5 years:

1. A. Tunyagi et.al., "An innovative system for monitoring Radon and indoor air quality", *ROMANIAN JOURNAL OF PHYSICS*, 65, 2020
2. A.A. Muresan, M. Nedelcu, R. Goncalves, GBT-based FE formulation to analyse the buckling behaviour of isotropic conical shells with circular cross-section, *THIN-WALLED STRUCTURES* Volume: 134 Pages: 84-101 Published: JAN 2019
3. R. Moga, R. Cosgarea, S. Buru, C.G. Chiorean, "Finite element analysis of the dental pulp under orthodontic forces", *AMERICAN JOURNAL OF ORTHODONTICS AND DENTOFACIAL ORTHOPEDICS*, 155(4), pp. 543-551,

2019.

4. L.A. Bredean, M.D. Botez, "The influence of beams and the slabs effect on the progressive collapse resisting mechanisms developed for RC framed structures", *ENGINEERING FAILURE ANALYSIS*, 91, 527-542, 2018.
5. C. G. Chiorean, "Second-order flexibility-based model for nonlinear inelastic analysis of 3D semi-rigid steel frameworks," *ENGINEERING STRUCTURES*, vol. 136, pp. 547-579, Apr 2017.
6. C. G. Chiorean and S. M. Buru, "Practical nonlinear inelastic analysis method of composite steel-concrete beams with partial composite action," *ENGINEERING STRUCTURES*, vol. 134, pp. 74-106, Mar 2017.
7. C. G. Chiorean and I. V. Marchis, "A second-order flexibility-based model for steel frames of tapered members," *JOURNAL OF CONSTRUCTIONAL STEEL RESEARCH*, vol. 132, pp. 43-71, May 2017.
8. Nedelcu M., Generalisation of the Ayrton-Perry formula for the global-distortional-local buckling of thin-walled members, *THIN-WALLED STRUCTURES*, vol. 118, pag. 73-86, 2017
9. S. Varga, C.G., Chiorean, Refined NSA Approach for Seismic Assessment of Regular RC Frames, *GRADEVINAR*, 69 (12), pp. 1137-1157, 2017.
10. M. Botez, L. Bredean, A. Ioani, "Improving the accuracy of progressive collapse risk assessment: Efficiency and contribution of supplementary progressive collapse resisting mechanisms", *COMPUTERS & STRUCTURES*, pp. 1-12, Elsevier Science Publisher, 2015.

Software developed

GFAS & RSL2D – (A Finite Element System for Geotechnical Applications) a product developed for [Geostru Corporation \(www.geostru.com\)](http://www.geostru.com) is a finite element package that has been developed specifically for the analysis of deformation and stability analysis in geotechnical engineering problems and local seismic response. <http://www.geostru.com/EN/Geotechnical-and-F.E.M.-analysis-system.aspx>

NEFCAD & ASEP – Advanced Nonlinear Inelastic Analysis System for Seismic Performance Evaluation of 3D Steel and Composite Steel-Concrete Frameworks (<http://www.cosminchiorean.com/software.html>)

The offer addressed to the economic environment

Research & development	<p>Development of advanced nonlinear analysis methods able to describe the complex behaviour of 3D steel, RC and composite steel-concrete frame structures, <i>under normal and abnormal loads</i>. Ultimate strength analysis and design of composite-steel concrete cross-sections with arbitrary shapes subjected to biaxial bending and axial force at elevated temperatures; Computer automated optimal structural design in seismic zones based on structural performance criteria; Analysis of structures subjected to extreme actions. Development of specialized software concerning application of nonlinear analysis to describe complex behaviour of frame structures. The stability of thin-walled members by using the Generalised Beam Theory. The elastic buckling behaviour of rectangular plates with initial geometric imperfections by using energy methods and trigonometric series approximation of the displacements field. The elasto-plastic behaviour of the joints between the precast RC members. The optimisation of scaling for testing the RC walls under cyclic lateral loading. The stiffness evaluation of the vertical and horizontal joints between precast RC walls. The structural health monitoring of bridges by Machine Learning algorithms trained on experimental and FE numerical data. The effect of FRP strengthening on hollow-core slabs. Application of FEM in geotechnical and multiphysics problems: Development of general purpose and dedicated purpose finite element package (GFAS) specifically for the analysis of deformation and stability analysis in geotechnical engineering problems. Advanced Computational Fluid Dynamics (CFD) models to identify the mechanisms of radon accumulation and developing techniques for reducing radon accumulation in homes. Numerical simulation of ballistic impact on composite laminated plates: The ballistic performance of the lightweight armour systems can be examined to obtain an estimate for the V50 and the global damage of the composite plates.</p>
Consulting	Application of nonlinear analysis methods for seismic performance evaluation of spatial structures; Application of FEM in structural and geotechnical engineering; Composite materials, Thin-walled structures, Experimental techniques.
Applied engineering services	Advanced analysis and Design of Structural Systems in Civil and Geotechnical Engineering. Software development for structural and geotechnical engineering.
Training	Advanced software applications such as: Abaqus, Ansys, GFAS, TrueGrid, MatLab; Extreme Loadings, Open Sees, etc. Application of nonlinear analysis for seismic performance evaluation of spatial structures; Application of FEM in Structural and Geotechnical Engineering and Multiphysics (CFD).