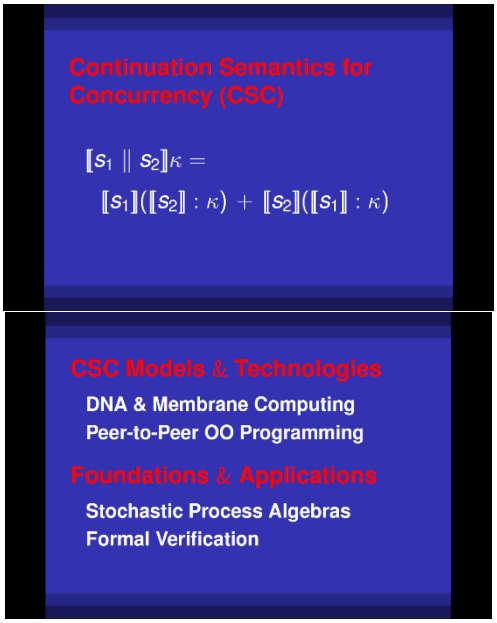
FOUNDATIONS AND APPLICATIONS OF ADVANCED SOFTWARE TECHNOLOGY - RESEARCH GROUP

Contact details

Name	**Foundations and Applications of Advanced Software Technology – Research Group**
Acronym	**FAAST**
Logo	FAAST Fondations and Applications of Advanced Software Technology
Site	http://users.utcluj.ro/~eneia/faast.htm
Address	26-28 G. Baritiu Str., room M05, 400027, Cluj-Napoca, Romania
Faculty Department	**Faculty of Automation and Computer Science Computer Science Department**
Telephone	+40 264 401481
Fax	+40 264 594491
Director	**Prof. Dr. Eng. Eneia Nicolae Todoran**
e-mail	Eneia.Todoran@cs.utcluj.ro



Areas of expertise

Software Engineering & Programming Languages:
- Formal Methods, Programming Languages Design and Semantics

Software Solutions for Smart City:
- eBusiness, eAdministration, eHealth, Medical Databases
- NetZeRo – Climate Neutral principles based Smart Traffic solutions and Urban Traffic Image Processing
- Cloud infrastructure based integrated architectures
- AI based green digital transformation techniques for public administration

Semantic Models and Technologies
- Nature Inspired Models of Computation: Membrane Computing, DNA Computing
- Global Computing (GC), Image Processing in GC Context

Computational models based on Big Data and predictive analysis
- mathematical models of predictive analysis
- computational models

AI based computational models for the domain of insurances
- Predictive Analysis based on telematic data, for the domain of insurances
- Clustering techniques, association rules, and attribute dependency mining applied in car insurance

Team

Prof. Dr. Eng. Eneia Nicolae Todoran, Assoc.Prof.Dr. Paulina Mitrea, Eng. Dorin Simina

Representative projects

Next Generation Brained City, "Innovative development through informatization of the urban ecosystem"- POSCCE/Op.1.3.3, no.13.C01.010, cod SMIS 49752 (2014-2015); sub-projects: **ProcessPlayer, "Platform for the optimization of process flows for and between the public authorities"**, collaboration with ARXIA SRL&UBB (Contract POSCCE No.1CLT/800.003/8/29.04.2014/Subproject SP1); **"Software services design for intelligent routing in urban road traffic in Smart City context"**(Contract POSCCE No.1CLT/800.003/8/29.04.2014/ Subpr. SF1)

SemNat, "Semantic models and technologies for natural computing" - CAPABILITIES, Module III, Greece-Romania bilateral collaboration project, no. 582/16.07.2012 (2012-2014)

BETTY-"Behavioral Types for Reliable Large-Scale Software Systems"/ICT-COST Action/IC1201, http://www.cost.eu/domains_actions/ict/Actions/IC1201 Management Committee members for Romania: Prof.Dr. Gabriel Ciobanu, Prof.Dr. Eneia Nicolae Todoran (2012-2016)

DFA@eInclusion, "Design for All for e-inclusion", FP7 project no. 033838, (2008-2010)

"Distributed System for Early Prevention, Monitoring and Treatment of the Cardio toxicity Induced by Chemotherapy and Radiotherapy in Oncologic Patients", PNII/IDEAS Project no. 1340/2009; (2008-2010)

GlobalComp, "Models, semantics, logics and technologies for global computing", ANCS, CNMP-PC, no. 11052/18.09.2007; (2007-2010).

Computational models based on Big Data and predictive analysis for the platform 24BrokerRo – POC/AP1, no 378/390054/01.10.2021 (2021-2023)

NetZero Cities – "National Competence Center for the development of climate neutral and Smart Cities", code 6/16.11.2022 Contract no. 760007/30.12.2022/Component Project P2 (Sustainable Energy and Environment)/WP2 & Component Project P4 (Smart Mobility and Infrastructure)/WP2

Significant results

The most representative publications of the past 5 years:

1. E.N. Todoran, G. Ciobanu, “Abstract Continuation Semantics for Multiparty Interactions in Process Calculus based on CCS”, *Electronic Proceedings in Theoretical Computer Science*, vol. 410, pp. 18-37, 2024.
2. D.Mitrea, P.Mitrea, E. Barna, “Employing Clustering Techniques and Association Rules, for Client Segmentation and Attribute Dependency Mining, in the domain of Car Insurance”, *Proceedings of AI- powered Innovation and Inventive Design World Conference,* vol. 2, pp. 232-247, Springer, 2024.
3. G. Ciobanu, E.N. Todoran, “Variants of Spiking Neural P Systems and their Operational Semantics in Haskell”, *Journal of Membrane Computing*, vol.5(2), pp. 81-99, Springer, 2023.
4. G. Ciobanu, E.N. Todoran, “Spiking Neural P Systems and Their Semantics in Haskell”, *Natural Computing*, vol.22(1), pp. 41-54, Springer, 2023.
5. E.N. Todoran, “Quantitative Programming and Continuous Time Markov Chains”, *Proc. IEEE SYNASC 2023*, pp. 104-113, 2023.
6. G. Ciobanu, E.N. Todoran, “A Process Calculus for Spiking Neural P Systems”, *Information Sciences*, vol.604, pp. 298-319, Elsevier, 2022.
7. E.N. Todoran, “Quantitative Programming and Markov Decision Processes”, *Proc. IEEE SYNASC 2022*, pp. 117-124, 2022.
8. E.N. Todoran, “Equivalence Classes in Performance Evaluation Programming”, *Proc. IEEE SYNASC 2021*, pp. 194-199, 2021.
9. E.N. Todoran, “Continuation Semantics for Interaction and Concurrency”, *Proc. IEEE ICCP 2021*, pp.189-197, 2021.
10. G. Ciobanu, E.N. Todoran, "Denotational semantics of membrane systems by using complete metric spaces", *Theoretical Computer Science*, vol. 701, pp. 85-108, Elsevier, 2017.
11. E.N. Todoran, N. Papaspyrou, "Concurrency Semantics in Continuation-Passing Style", *Fundamenta Informaticae*, vol. 153, no. 1-2, pp. 125-146, IOS Press, 2017.
12. D. Mitrea, S. Nedevschi, Paulina Mitrea, et al, *The role of the cooccurrence matrix based on complex extended microstructures in discovering the cirrhosis severity grades within US images* - 10th International Congress on Image and Signal Processing, BioMedical Engineering and Informatics, CISP-BMEI 2017, pp.1-6, Shanghai, China, October 14-16, 2017. IEEE 2017
13. G. Ciobanu, E. N. Todoran, “Correct Metric Semantics for a Language Inspired by DNA Computing”, *Concurrency and Computation: Practice and Experience*, vol. 28(11), pp. 3042-3060, Wiley, 2016.
14. E.N. Todoran, P. Mitrea, “Semantic investigation of a control-flow subset of BPMN 2.0”, *Proc. IEEE ICCP 2015*, pp. 483-490, 2015.
15. I. Chifor, P. Mitrea, et al, “Mathematical methods for assessing the prognostic of fixed partial dentures resulting from evaluating a group of dental patients”, *Computational and Mathematical Methods in Medicine*, vol. 2014, article ID 984901, http://dx.doi.org/10.1155/2014/98490, 2014.
16. S. Brad, P. Mitrea, “Functional and strategic aligned clusters towards more united economies and sustainable development”, JCI 2015 Proceedings, *ISBN print: 978-3-8487-2429-1, ISBN online: 978-3-8452-6588-9, DOI: 10.5771/9783845265889-126*
17. A.I. Mitrea, S. Nedevschi, D. Mitrea, P. Mitrea, “Diseased tissue area detection and delimitation by fusion between finite difference methods and textural analysis”, *Proc. AQTR 2014*, pp. 1-5, 2014.
18. E.N. Todoran, D. Simina, et al, “Mobile Objects and Modern Communication Abstractions: Design Issues and Denotational Semantics”, *Proc. IEEE ISPDC 2011*, pp. 191-198, 2011.

Significant solutions:

Continuation semantics for concurrency, concurrency semantics in continuation-passing style, denotational semantics for nature inspired models of computation (membrane computing, DNA computing), denotational semantics for multiparty interactions, denotational semantics for models of global computing, Quantitative Programming (or Performance Evaluation Programming) – a programming paradigm providing support for performance analysis and formal verification of concurrent systems using model checking techniques

Products and technologies:

Prototype interpreters for mobile objects, process calculi and nature inspired models of computation
Prototype interpreter for a concurrent language which supports the quantitative programming paradigm
Prototype interpreter for a control flow subset of BPMN 2.0
Prototypes for medical image processing in global computing context
Communication prototypes for smart sensor networks

The offer addressed to the economic environment

R & D	Formal design of reliable distributed software systems and programming languages
Consulting	Formal design of reliable distributed software systems and programming languages
Training	**Software Engineering:** software development paradigms, UML class diagrams and OO analysis, modeling interaction and behavior, architecting and designing software, software testing techniques and strategies, PRISM probabilistic model checking **Advanced Topics in Software Engineering and Programming Languages:** formal methods, denotational and operational semantics, stochastic process algebras, type systems

Last updated: January 2025