

Eduard Kamburjan

Personal Data

Name Eduard Kamburjan
Work University of Oslo
Contact Postboks 1080
Blindern, 0373 Oslo, Norway
Mail: eduard@ifi.uio.no
Website edkamb.github.io

Education

2016 – 2020 **PhD**, *Technical University of Darmstadt*.
Passed with distinction (summa cum laude), advisor: Prof. Reiner Hähnle, dissertation:
Modular Verification of a Modular Specification: Behavioral Types as Program Logics
2014 – 2016 **M.Sc.**, in *Computer Science*, *Technical University of Darmstadt*, .
2011 – 2014 **B.Sc.**, in *Computer Science*, *Technical University of Darmstadt*, .

Employment

Since 2020 **Postdoctoral Fellow**, *University of Oslo*.
Analytical Solutions and Reasoning Group.

- Digital twins in the energy industry in cooperation with Equinor, Petrobras and Shell
- Integration of techniques from the semantic web with programming languages
- Formal approaches to co-simulation

2016–2020 **Research Assistant**, *Technical University of Darmstadt*.
Software Engineering Group.

- Modeling and verification of railway operations in cooperation with the Institute for Railway Engineering and DB Netz AG
- Development of new specification and verification approaches for Active Objects
- Development of a new variability modeling principle
- Development of a hybrid extension of Active Objects

2013–2016 **Student Assistant**, *Technical University of Darmstadt*.
Software Engineering Group. Implementing loop invariant inference in the KeY system.

Community Service

- PC Chair *Workshop on Formal Methods and Digital Twins* (located with FM'23)
- Track Chair FASE'22 (*Artifact Evaluation* track)
ISoLA'20 (*Modularity and (De-)composition in Verification* track)
- PC Member SAC'23 (*Software Verification and Testing* track)
SPLC'22 (*Journal First* track)
SPLC'21 (*Journal First* track)
ECOOP'21 (*Artifact Evaluation* track)
OOPSLA'21 (*Artifact Evaluation* track)
SPLC'18 (*Challenges* track)
- Guest Editor Science of Computer Programming, Special Issue on FASE'22 Artifacts (forthcoming)
Special LNCS Volume on the State of the Art in Active Objects (forthcoming)
- External Reviewer FM'23,'21,'19, FASE'22,'21,'20,'19,'18, iFM'22,'20,'19,'17, TAP'22,'21,'19, COORDINATION'22,'21, ISoLA'22, SEFM'22, FORTE'22, CoSim Workshop'21, FTfJP'21, (Conferences) DaLi'20,'19, ICTAC'20, FOSSACS'20, TABLEAUX'19, CADE'19, IJCAR'18, CPP'18
Total: 33 conference and workshop articles for 30 venues as an external reviewer.
- (Journals) Software and System Modeling, Science of Computer Programming, Computing, Journal of Systems and Software
Total: 8 journal articles for 4 journals as an external reviewer.
- (Grants) Dutch Research Council (NWO)
- Organizer ABS Workshop'21
ABS Workshop'18

Presentations at International Venues with Peer-Review

- 1 "*Knowledge Structures over Simulation Units*"
ANNSIM'22, virtual [9]
- 2 "*Never Mind the Semantic Gap: Modular, Lazy and Safe Loading of RDF Data*"
ESWC'22, Hersonissos, Greece [1]
- 3 "*Designing Distributed Control with Hybrid Active Objects*"
ISoLA'21, Rhodes, Greece [16]
- 7 "*Optimizing Semantically Lifted Programs through Ontology Modularity*"
NWPT'21, Reykjavik, Iceland [31]
- 4 "*Variability Modules for Java-like Languages*"
SPLC'21, online [15]
- 5 "*From Post-Conditions to Post-Region Invariants*"
HSCC'21, online [2]
- 6 "*Programming and Debugging with Semantically Lifted States*"
ESWC'21, online [14]
- 9 "*Increasing Engagement with Interactive Visualization: Formal Methods as Serious Games*", FMTea@FM'21, online [30]
- 10 "*Type Checking Semantically Lifted Programs via Query Containment under Entailment Regimes*", DL Workshop'21, online [29]

- 11 *"Asynchronous Cooperative Contracts for Cooperative Scheduling"*
SEFM'19, Oslo, Norway [20]
- 12 *"Behavioral Program Logic"*
TABLEAUX'19, London, UK [3]
- 13 *"Tool Support for Validation of Formal System Models"*
F-IDE'19, Porto, Portugal [32]
- 14 *"Interoperability of software product line variants"*
SPLC'18, Gothenborg, Sweden [23]
- 15 *"Stateful Behavioral Types for Active Objects"*
iFM'18, Maynooth, Ireland [21]
- 16 *"Prototyping Formal System Models with Active Object"*
ICE'18, Madrid, Spain [33]
- 17 *"Detecting Deadlocks in Formal System Models with Condition Synchronization"*
AVoCS'18, Oxford, UK [34]
- 18 *"Asynchronous Cooperative Contracts for Cooperative Scheduling"*
NWPT'18, Oslo, Norway (abstract of [20])
- 19 *"Deductive Verification of Railway Operations"*
RSSRail'17, Pistoia, Italy [24]
- 20 *"Uniform Modeling of Railway Operations"*
FTCSC'16, Tokyo, Japan [35]
- 21 *"Session-Based Compositional Analysis for Actor-Based Languages Using Futures"*
ICFEM'16, Tokyo, Japan [26]
- 22 *"Session Types for ABS"*
NWPT'15, Reykjavik, Iceland (abstract of [26])

Invited Presentations

- 1 *"Semantically Lifted Programming"*
TCS Seminar, KTH Stockholm, 16.09.23
- 2 *"Semantic Programming"*
BLDL Group Seminar, University of Bergen, 19.05.22
- 3 *"Session Types as Program Logics"*
Dagstuhl Seminar 21372, 14.09.21

Other Presentations

- Workshop *"Hybrid Active Objects"*
Workshop on Distributed Hybrid Systems'18, Amsterdam, Netherlands
- Workshop *"Prototyping Formal System Models with Active Objects"*
Workshop on Actors and Active Objects'17, Turin, Italy
- Workshop *"The future Use Cases of Formal Methods in Railways"*
Scientific Railway Signalling Symposium'18, Darmstadt, Germany
- Workshop *"Formalisierung von betrieblichen und anderen Regelwerken – Das FormbaR-Projekt"*
Scientific Railway Signalling Symposium'17, Darmstadt, Germany

Project *"KeY-Style Verification for ABS and Hybrid ABS"*
 Workshop International KeY Symposium'21 (online)

Project *"Behavioral Program Logic"*
 Workshop International KeY Symposium'19, Manigod, France

Project *"Hybrid Active Objects"*
 Workshop International KeY Symposium'19, Manigod, France

Project *"Update on KeY-ABS"*
 Workshop International KeY Symposium'17, Rastatt, Germany

Project *"Session Types for ABS"*
 Workshop International KeY Symposium'16, Manigod, France

Project *"Modeling Railways with ABS and KeY-ABS"*
 Workshop International KeY Symposium'16, Manigod, France

Project *"Abstract Object Creation for an Explicit Heap Representation"*
 Workshop International KeY Symposium'14, Bühl, Germany

Project *"Crowbar and Hybrid ABS"*
 Workshop ABS Workshop'21 (online)

Project *"Behavioral Program Logic"*
 Workshop ABS Workshop'19, Amsterdam, Netherlands

Project *"Hybrid Active Objects"*
 Workshop ABS Workshop'19, Amsterdam, Netherlands

Project *"Asynchronous Method Contracts for ABS"*
 Workshop ABS Workshop'18, Darmstadt, Germany

Project *"Experiences with await on Fields"*
 Workshop ABS Workshop'17, Oslo, Norway

Project *"Session Types for ABS"*
 Workshop ABS Workshop'16, Oslo, Norway

Invitations

Dagstuhl Seminar 21372 on *Behavioural Types: From theory to practice*
 Dagstuhl Seminar 22451 on *Principles of Contract Languages* (forthcoming)

Awards and Stipends

Scholarship Kristine Bonnevie travel stipend 2023, from the Faculty of Mathematics and Natural Sciences of UiO for young excellent researchers, worth 21 000 NOK

Award Best Research Paper ESWC 2022

Industrial Collaborations

2016 – 2020 With DB Netz AG, as project member of the FormbaR project, funded by DB AG. Modelling railway operations books to increase maintainability.

since 2020 With Equinor, Petrobras and Shell, as project member of the PeTWIN project, funded by the Norwegian Research Council. Combining knowledge graphs and programs to handle asset models in digital twins of petroleum industry facilities.

Teaching Experience

Course	<i>Models of Concurrency</i> , Autumn Term'22	<i>Lecturer (on-going)</i>
Course	<i>Analysis of Hybrid Systems</i> , Summer Term'20	<i>Lectured and Designed the Course</i>
Course	<i>Automatic Theorem Proving</i> , Summer Term'18	<i>As Teaching Assistant</i>
Seminar	<i>Actor Languages</i> , Winter Term'19	<i>As Teaching Assistant</i>
Seminar	<i>Symbolic Execution</i> , Summer Term'19	<i>As Teaching Assistant</i>
Seminar	<i>Software Failures</i> , Summer Term'17	<i>As Teaching Assistant</i>
Grading	<i>Operational Systems</i> , Autumn'21 at the University of Bergen.	<i>As External Examiner</i>
Project	<i>KalkulierbaR</i> , Winter Term'20	<i>As supervisor</i>
Project	<i>KollaborierbaR</i> , Winter Term'19	<i>As supervisor</i>
Project	<i>VisualisierbaR II</i> , Winter Term'18	<i>As supervisor</i>
Project	<i>VisualisierbaR I</i> , Winter Term'17	<i>As supervisor</i>

Thesis and Student Supervision

Master	<i>Semantic Debugging for the JVM</i>	2022
Master	<i>Implementing Variability-aware Modules</i>	2020
Master	<i>Evaluation of ABS in Modeling Real World Safety-Critical Systems</i>	2018
Master	<i>A Formal Model of a Railway Operating Procedure with Moving Blocks and Dynamic Speed Profile</i> ,	2017
Bachelor	<i>Introducing and Exploiting Extended Types for ABS</i>	2020
Bachelor	<i>Counterexample Generation for Formal Verification of ABS</i>	2020, published in [37]
Bachelor	<i>Semi-Dynamic Session Types for ABS</i>	2019, published in [18]
Bachelor	<i>Makroskopisches Editieren von prototypischen Eisenbahnbetriebsverfahren</i>	2019, published in [32]
Bachelor	<i>Formalizing the Concurrency Model of AOs in a Linearization Framework</i>	2019
Bachelor	<i>Concept Formation in Computer Science: Modeling and Programming</i>	2019
Bachelor	<i>Hybrid Active Objects mit ABS</i>	2018
Bachelor	<i>Active Object Languages for Railway Modeling</i>	2018
Study Thesis	<i>Practical Counterexample Generation and Lightweight Session Types for ABS</i>	2021
Master (Examiner)	<i>Exploring Automatic Text Simplification of Requirements</i>	2022
Master (Examiner)	<i>Commutativity Analysis in ABS</i>	2021

Software

Main Author	SMOL smolang.org , actively maintained since 2021 <i>A language and interpreter combining knowledge graphs and object-orientation</i>
Main Author	Crowbar github.com/edkamb/crowbar-tool , actively maintained since 2020 <i>A deductive verification system for active objects</i>
Main Author	Hybrid ABS Compiler formbar.raillab.de/habs , actively maintained since 2018 <i>An extension of active objects with differential equations for dynamic behavior</i>

- Contributor ABS Compiler `abs-models.org`, since 2017
Responsible for the variability layer
- Contributor KeY Verification System `key-project.org`, 2014-2016
Implemented an approach for loop invariant inference

Publications

I have published in total 35 peer-reviewed articles: 31 in the proceedings of international conferences and workshops, and 4 journal articles.

Total number of citations in Google Scholar: 231. h-index: 9, i10-index: 9 (according to <https://scholar.google.de/citations?user=-GBTu1YAAAAAJ>, 26.09.2022).

Selected Conference Publications

- [1] Eduard Kamburjan, Vidar Norstein Klungre, and Martin Giese. *Never Mind the Semantic Gap: Modular, Lazy and Safe Loading of RDF Data*. In *ESWC, LNCS 13261*, 2022. **Best Paper Award**.
- [2] Eduard Kamburjan. *From Post-Conditions to Post-Region Invariants: Deductive Verification of Hybrid Objects*. In *HSCC*. ACM, 2021.
- [3] Eduard Kamburjan. *Behavioral Program Logic*. In *TABLEAUX, LNCS 11714*, 2019.

Journal Articles

- [4] Rudolf Schlatte, Einar Broch Johnsen, Eduard Kamburjan, and Silvia Lizeth Tapia Tarifa. *The ABS Simulator Toolchain*. *Sci. Comput. Program.*, 2022. in print.
- [5] Eduard Kamburjan, Stefan Mitsch, and Reiner Hähnle. *A Hybrid Programming Language for Formal Modeling and Verification of Hybrid Systems*. *Leibniz Trans. Embed. Syst.*, 2022. in print.
- [6] Ferruccio Damiani, Reiner Hähnle, Eduard Kamburjan, Michael Lienhardt, and Luca Paolini. *Variability Modules*. *Journal of Systems and Software*, 2022. in print.
- [7] Eduard Kamburjan, Reiner Hähnle, and Sebastian Schön. *Formal modeling and analysis of railway operations with active objects*. *Sci. Comput. Program.*, 166, 2018.

Conference Publications

- [8] Eduard Kamburjan, Vidar Norstein Klungre, Rudolf Schlatte, S. Lizeth Tarifa Tapia, David Cameron, and Einar Broch Johnsen. *Digital Twin Reconfiguration Using Asset Models*. In *ISoLA*. Springer, 2022. Accepted for publication.
- [9] Eduard Kamburjan and Einar Broch Johnsen. *Knowledge Structures over Simulation Units*. In *ANNSIM*. IEEE, 2022.
- [10] Eduard Kamburjan and Sandro Rama Fiorini. *On the notion of naturalness in formal modeling*. In *The Logic of Software. A Tasting Menu of Formal Methods, LNCS 13360*, 2022.
- [11] Eduard Kamburjan, Crystal Chang Din, Rudolf Schlatte, S. Lizeth Tarifa Tapia, and Einar Broch Johnsen. *Twinning-by-Construction: Ensuring Correctness for Self-Adaptive Digital Twins*. In *ISoLA*. Springer, 2022. Accepted for publication.
- [12] Ole Jørgen Abusdal, Eduard Kamburjan, Violat Ka I Pun, and Volker Stolz. *A Notion of Equivalence for Refactorings with Abstract Execution*. In *ISoLA*. Springer, 2022. Accepted for publication.
- [13] Rudolf Schlatte, Einar Broch Johnsen, Eduard Kamburjan, and S. Lizeth Tapia Tarifa. *Modeling and analyzing resource-sensitive actors: A tutorial introduction*. In *COORDINATION, LNCS 12717*, 2021.

- [14] Eduard Kamburjan, Vidar Norstein Klungre, Rudolf Schlatte, Einar Broch Johnsen, and Martin Giese. *Programming and Debugging with Semantically Lifted States*. In *ESWC, LNCS 12731*, 2021.
- [15] Ferruccio Damiani, Reiner Hähnle, Eduard Kamburjan, Michael Lienhardt, and Luca Paolini. *Variability Modules for Java-like Languages*. In *SPLC*. ACM, 2021.
- [16] Eduard Kamburjan, Rudolf Schlatte, Einar Broch Johnsen, and S. Lizeth Tapia Tarifa. *Designing Distributed Control with Hybrid Active Objects*. In *ISoLA, LNCS 12479*, 2020.
- [17] Eduard Kamburjan, Crystal Chang Din, Reiner Hähnle, and Einar Broch Johnsen. *Behavioral Contracts for Cooperative Scheduling*. In *20 Years of KeY, LNCS 12345*. 2020.
- [18] Reiner Hähnle, Anton Haubner, and Eduard Kamburjan. *Locally Static, Globally Dynamic Session Types for Active Objects*. In *Recent Developments in the Design and Implementation of Programming Languages, OASlcs 86*. Schloss Dagstuhl, 2020.
- [19] Dilian Gurov, Reiner Hähnle, and Eduard Kamburjan. *Who Carries the Burden of Modularity? - Introduction to ISoLA 2020 Track on Modularity and (De-)composition in Verification*. In *ISoLA, LNCS 12476*, 2020.
- [20] Eduard Kamburjan, Crystal Chang Din, Reiner Hähnle, and Einar Broch Johnsen. *Asynchronous Cooperative Contracts for Cooperative Scheduling*. In *SEFM, LNCS 11724*, 2019.
- [21] Eduard Kamburjan and Tzu-Chun Chen. *Stateful Behavioral Types for Active Objects*. In *IFM, LNCS 11023*, 2018.
- [22] Ferruccio Damiani, Reiner Hähnle, Eduard Kamburjan, and Michael Lienhardt. *Same Same But Different: Interoperability of Software Product Line Variants*. In *Principled Software Development*, 2018.
- [23] Ferruccio Damiani, Reiner Hähnle, Eduard Kamburjan, and Michael Lienhardt. *Interoperability of software product line variants*. In *SPLC*. ACM, 2018.
- [24] Eduard Kamburjan and Reiner Hähnle. *Deductive Verification of Railway Operations*. In *RSSRail, LNCS 10598*, 2017.
- [25] Ferruccio Damiani, Reiner Hähnle, Eduard Kamburjan, and Michael Lienhardt. *A Unified and Formal Programming Model for Deltas and Traits*. In *FASE, LNCS 10202*, 2017.
- [26] Eduard Kamburjan, Crystal Chang Din, and Tzu-Chun Chen. *Session-Based Compositional Analysis for Actor-Based Languages Using Futures*. In *ICFEM, LNCS 10009*, 2016.
- [27] Quoc Huy Do, Eduard Kamburjan, and Nathan Wasser. *Towards Fully Automatic Logic-Based Information Flow Analysis: An Electronic-Voting Case Study*. In *POST, LNCS 9635*, 2016.

Workshop Publications

- [28] Eduard Kamburjan and Nathan Wasser. *The Right Kind of Non-Determinism: Using Concurrency to Verify C Programs with Underspecified Semantics*. In *ICE. EPTCS*, 2022.
- [29] Eduard Kamburjan and Egor V. Kostylev. *Type Checking Semantically Lifted Programs via Query Containment under Entailment Regimes*. In *Description Logic Workshop, CEUR Workshop Proceedings 2954*. CEUR-WS.org, 2021.

- [30] Eduard Kamburjan and Lukas Grätz. *Increasing Engagement with Interactive Visualization: Formal Methods as Serious Games*. In *Formal Methods Teaching*, LNCS 13122, 2021.
- [31] Eduard Kamburjan and Jieying Chen. *Optimizing Semantically Lifted Programs through Ontology Modularity*. In *NWPT*. Reykjavik University Technical Reports, 2021.
- [32] Eduard Kamburjan and Jonas Stromberg. *Tool Support for Validation of Formal System Models: Interactive Visualization and Requirements Traceability*. In *F-IDE@FM, EPTCS 310*, 2019.
- [33] Eduard Kamburjan and Reiner Hähnle. *Prototyping Formal System Models with Active Objects*. In *ICE, EPTCS 279*, 2018.
- [34] Eduard Kamburjan. *Detecting Deadlocks in Formal System Models with Condition Synchronization*. *AVoCS, Electron. Commun. Eur. Assoc. Softw. Sci. Technol.*, 76, 2018.
- [35] Eduard Kamburjan and Reiner Hähnle. *Uniform Modeling of Railway Operations*. In *FTSCS, CCIS 694*, 2016.

■ PhD Thesis

- [36] Eduard Kamburjan. *Modular Verification of a Modular Specification: Behavioral Types as Program Logics*. PhD thesis, Technical University of Darmstadt, 2020.

■ Preprints

- [37] Eduard Kamburjan, Marco Scaletta, and Nils Rollshausen. *Crowbar: Behavioral Symbolic Execution for Deductive Verification of Active Objects*. *CoRR*, abs/2102.10127, 2021.