BENTLEY J OAKES

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KEY ACADEMIC SKILLS SUMMARY

Researcher - Lead- and co-author of 30+ publications with 260+ citations on Google Scholar.
Collaborator - Involved in multiple international academic and industrial collaborations.
Teacher/Mentor - Extensive experience teaching courses and mentoring graduate students.
Community-Builder - Organizing & program committee member for local & global events.

LANGUAGE SKILLS

English - Native proficiency   **French** - A2 proficiency (elementary)

EDUCATION

Doctor of Philosophy (PhD), Computer Science   2019
McGill University - Montréal, Canada
Title: A Symbolic Execution-Based Approach To Model Transformation Verification using Structural Contracts
Supervisors: Hans Vangheluwe and Clark Verbrugge

Master of Science, Computer Science   2013
McGill University - Montréal, Canada
Title: Practical and Theoretical Issues of Evolving Behaviour Trees for a Turn-Based Game
Supervisor: Clark Verbrugge

Bachelor of Science, Computer Science   2011
University of Manitoba - Winnipeg, Canada
Honours Level, Co-op option with three work-terms:

Assistant Software Engineer   Fall 2009, Summer 2010
Electronic Arts Inc., Montréal, Canada
Role: Prototyping artificial intelligence in commercial video games.

Assistant Software Engineer   Winter 2009
Blackberry Limited (RIM), Waterloo, Canada
Role: Implementing cryptographic communication protocols.

RESEARCH EXPERIENCE

Assistant Professor
Polytechnique Montréal - Montréal, Canada   **Sept. 2023 to Present**
Department: Department of Computer Engineering and Software Engineering (GIGL)

Post-Doctoral Researcher
Université de Montréal - Montréal, Canada   **Sept. 2021 to Aug. 2023**
Lab: GEODES Software Engineering Research Group
Supervisors: Houari Sahraoui and Michalis Famelis
Research topic: Assisting non-machine learning experts in constructing machine learning solutions by exploring tailoring of computational workflows.

University of Antwerp - Antwerp, Belgium   **Sept. 2018 to July 2021**
Labs: Antwerp Systems and Software Modelling, and Constrained Systems Lab
Supervisors: Hans Vangheluwe and Joachim Denil
Research topics: Verification and validation of cyber-physical systems, model-driven engineering, multi-paradigm modelling, co-simulation, and digital twins.

Visiting Researcher
Université de Montréal - Montréal, Canada   **May 2018**
Host: Eugene Syriani, GEODES Software Engineering Research Group
Research topic: Developing an interface between the AToMPM modelling tool and the ModelVerse modelling repository.

fortiss GmbH - Munich, Germany   **July to Aug. 2016**
Host: Levi Lúcio
Research topic: Formalizing representations of model transformation languages.

General Motors Technical Center - Warren, USA   **Oct. to Dec. 2014**
Host: Ramesh Sethu
Research topics: Applying model transformations for code/model modernization at an industrial scale, and industrial intellectual property concerns.

INDUSTRIAL COLLABORATIONS

Framework for Systematic Design of Digital Twins (DTDesign)   2019 - 2021
Project goal: Develop a methodology and tools for industrial partners to efficiently and systematically build digital twins.
Main collaborators: Atlas Copco, Flanders Make
Topics addressed: Digital twin characteristics, integrating knowledge graphs and digital twins.
Publications: [Oakes2021, Oakes2021b, Oakes2023c]
Funding: Flanders Innovation and Entrepreneurship Agency (VLAIO)

Automated & Simulation-based Functional Safety Eng. Methodology (aSET) 2018 - 2020
Project goal: Develop methodologies to reduce time and cost of the functional safety engineering process through automation.
Main collaborators: Dana Belgium NV, Siemens Industry Software (Leuven), Flanders Make
Topics addressed: Verification of safety-critical cyber-physical systems (formal methods, fault

injection using machine learning, simulation/visualization), DevOps for functional safety.
Publications: [Bernaerts2019, Meyers2019, Moradi2020, Moradi2020a, Oakes2021a]
Funding: Flanders Innovation and Entrepreneurship Agency (VLAIO)

Innovation in the Development of Electrical Systems For Aeronautics (INES) 2019 - 2020
Project goal: Provide a model-based systems engineering methodology for the development, validation, and verification of avionics systems to reduce time and cost.
Main collaborators: Boeing Research & Technology Europe (Madrid), Siemens Industry Software (Leuven), Flanders Make
Topics addressed: Co-simulation configuration, fault injection in co-simulation.
Publications: [Gomes2019, Moradi2019, Oakes2020]
Funding: Flanders Innovation and Entrepreneurship Agency (VLAIO)

Network for the Engineering of Complex Software-Intensive Systems for Automotive Systems (NECSIS) 2013-2016
Project goal: Advance model-driven engineering tools and techniques for managing the complexity of automotive software development.
Main collaborators: General Motors of Canada Ltd., Queen's University, University of Antwerp
Topic addressed: Verification of model transformations.
Publications: [Selim2014, Lucio2015, Selim2015 Oakes2015, Oakes2018a, Oakes2018b]
Funding: $14M from Automotive Partnership Canada and Natural Sciences and Engineering Research Council of Canada (NSERC)

TEACHING EXPERIENCE

Guest Lecturer Nov. 2022
Polytechnique Montréal - Montréal, Canada
LOG6953DE - Model-Driven Software Engineering
Professor: Mohammad Hamdaqa
Lecture topics: Model-driven engineering, usage and verification of model transformations.

Teaching Assistant
University of Antwerp - Antwerp, Belgium
Professor: Hans Vangheluwe
Level: Graduate
2001WETMTR - Model-Driven Engineering **Fall 2020**
Role:
  – Developed and graded practical assignments utilizing model-driven engineering tools.
  – Held virtual and in-person lab sessions to assist students with tool usage.

2001WETMSI - Modelling of Software-Intensive Systems **Fall 2019**
Role: Developed and graded Petri Net assignment focusing on modelling and verification.

Course Lecturer/Coordinator   Winter 2015, 2017, and 2018
McGill University - Montréal, Canada
COMP 202 - Foundations of Programming - Six terms
Level: Undergraduate
Average enrollment per lecture: 189 students
Role:
– Developed and presented material for engaging course lectures covering Java programming topics, targeted towards students with no prior programming experience.
– Created multiple-choice, short answer, and long-answer questions and marking guides for course assignments and exams.
– Coordinated with other instructors and teaching assistants to ensure consistency in course material and meet teaching objectives.

Teaching Assistant   2012 to 2014
McGill University - Montréal, Canada
COMP 202 - Foundations of Programming (x2)
COMP 250 - Introduction to Computer Science (x2)
COMP 251 - Data Structures and Algorithms (x3)
Level: Undergraduate
Role:
– Provided constructive criticism on assignments and offering helpful suggestions and resources via online class forums, tutoring appointments, and email.
– Marked exams and assignments in collaboration with other teaching assistants and provided feedback to lecturers.

Graduate Student Mentoring   2019 to Present
Role: Strong co-author support, recommending publication venues, extending invitations to program committees.

Student	Degree	Institution	Co-Authored Publications
Matthias Bernaerts	Master's	U. Antwerp	[Meyers2019, Bernaerts2019]
Mehrdad Moradi	PhD	U. Antwerp	[Moradi2019, Moradi2020, Moradi2020a, Oakes2021a]
Bert Van Acker	PhD	U. Antwerp	[VanAcker2020]
Cláudio Gomes	PhD	U. Antwerp	[Gomes2019, Oakes2020]
Mouna Dhaouadi	PhD	U. Montréal	[Dhaouadi2022,Dhaouadi2023]

COMMUNITY BUILDING

Lead Organizer

Software Engineering at Montréal (SEMTL)   Aug. 2022 - Present
Summary: Regular seminars for the software engineering researchers in Montréal.
Website: https://semtl.github.io/
Attendance: ≈40 attendees per meeting, ≈30% are professors
Role:
– Leading organizational committee to define group vision and roadmap.
– Coordinating with meeting hosts on content, venue, date, and maintaining website.
– Hosted Sept. 2022 meeting and presented current research.

Organizing Committee Member

Annual Modeling and Simulation Conference (ANNSIM)
Proceedings Co-Chair   2024
Cyber-Physical Systems Track Co-Chair   2022, 2023
Model Driven Engineering Languages and Systems (MODELS)   2022
Posters Co-Chair

Panelist

ANNSIM - *PhD Colloquium Panel*   2023

Session Chair

Consortium for Software Engineering Research (CSER) Spring Meeting   2023
Model-Driven Engineering and Software Development (MODELSWARD)   2021

External Reviewer

McGill University - *M. Sc. Thesis*   2023

Guest Editor for Journal Special Issue

SIMULATION   2024
Modeling and Simulation for Software-Intensive Systems: from IoT to Digital Twins

Journal Reviewer

Journal of Software and Systems Modeling (SoSyM)   2020, 2021, 2023
SIMULATION   2023
Science of Computer Programming (SCP)   2023
Journal of Computer Languages (JCL)   2022, 2023
Journal of Object Technology (JOT)   2022
Empirical Software Engineering (EMSE)   2022
IEEE Transactions on Automation Science and Engineering (T-ASE)   2021

Program Committee Member

MDE Intelligence Workshop   2023
Annual Modeling and Simulation Conference (ANNSIM)   2021 to 2023
Workshop on Artificial Intelligence and Model-Driven Engineering   2022
International Workshop on Models and Evolution   2022
ACM Student Research Competition   2022
Spring Simulation Conference   2020
Summer Simulation Conference   2019, 2020

SCHOLARSHIPS AND AWARDS

– *Journal of Software & Systems Modeling (SoSyM) Top 1% Reviewer*   **2020, 2021**
– *Best Student Paper Award* at SIMULTECH   **2019**
  for the paper *HintCO – Hint-based configuration of co-simulations*
– *NSERC Postgraduate Scholarship - Doctoral (PGS D)*,   **2015 to 2016**
  Natural Sciences and Engineering Research Council of Canada
– *Lorne Trottier Science Accelerator Fellowship*, McGill University   **2015, 2016**
– *Harold H. Helm Fellowship*, McGill University   **2013, 2014**
– *Grad Excellence Award in Computer Science*, McGill University   **2012, 2014**

PUBLICATIONS

Links: ⊕ 🎓 ⓘD 📓

Journal Articles

– [Oakes2023b] **B. Oakes**, J. Troya, J. Galasso, and M. Wimmer, "Fault localization in model transformations by combining symbolic execution and spectrum-based analysis," *Software and System Modeling*, 2023. Accepted

– [VaraminyBahnemiry2023] Z. VaraminyBahnemiry, J. Galasso, **B. Oakes**, and H. Sahraoui, "Improving repair of semantic ATL errors using a social diversity metric," *Software and System Modeling*, 2023. Under review

– [Oakes2022] **B. Oakes**, M. Famelis, and H. Sahraoui, "Building domain-specific machine learning workflows: A conceptual framework for the state-of-the-practice," *arXiv preprint arXiv:2203.08638*, 2022. Under review.

– [Oakes2018a] **B. Oakes**, J. Troya, L. Lúcio, and M. Wimmer, "Full contract verification for ATL using symbolic execution," *Software and System Modeling*, vol. 17, no. 3, pp. 815–849, 2018

Book Chapters

– [Oakes2023a] **B. Oakes**, A. Parsai, B. Meyers, I. David, S. Van Mierlo, S. Demeyer, J. Denil, P. De Meulenaere, and H. Vangheluwe, "A digital twin description framework and its mapping to Asset Administration Shell," in *Communications in Computer and Information Science*, vol. 1708, pp. 1–24, Springer, Aug. 2023

– [Karaduman2022] B. Karaduman, **B. Oakes**, R. Eslampanah, J. Denil, H. Vangheluwe, and M. Challenger, "An architecture and reference implementation for WSN-Based IoT systems," in *Emerging Trends in IoT and Integration with Data Science, Cloud Computing, and Big Data Analytics*, pp. 80–103, IGI Global, 2022

– [Oakes2020] **B. Oakes**, C. Gomes, F. R. Holzinger, M. Benedikt, J. Denil, and H. Vangheluwe, "Hint-based configuration of co-simulations with algebraic loops," in *9th International Conference, SIMULTECH 2019 Prague, Czech Republic, July 29-31, 2019, Revised Selected Papers*, vol. 1260, pp. 1–28, Springer, 2020

Peer-reviewed Conferences

- [Oakes2023c] **B. Oakes**, C. Gomes, J. Denil, J. Deantoni, J. Cambeiro, J. Fitzgerald, and P. G. Larsen, "Examining model qualities and their impact on digital twins," in *2023 Annual Modeling and Simulation Conference (ANNSIM)*, pp. 220–232, IEEE, IEEE, 2023

- [Dhaouadi2023] M. Dhaouadi, **B. Oakes**, and M. Famelis, "Towards understanding and analyzing rationale in commit messages using a knowledge graph approach," in *2023 International Conference on Model Driven Engineering Languages and Systems Companion (MODELS-C)*, 2023

- [Elaasar2023] M. Elaasar, N. Rouquette, D. Wagner, **B. Oakes**, A. Hamou-Lhadj, and M. Hamdaqa, "openCAESAR: Balancing agility and rigor in model-based systems engineering," *2023 International Conference on Model Driven Engineering Languages and Systems Companion (MODELS-C)*, 2023

- [Dhaouadi2022] M. Dhaouadi, **B. Oakes**, and M. Famelis, "End-to-end rationale reconstruction," in *37th IEEE/ACM International Conference on Automated Software Engineering*, pp. 1–5, 2022

- [Oakes2021a] **B. Oakes**, M. Moradi, S. Van Mierlo, H. Vangheluwe, and J. Denil, "Machine learning-based fault injection for hazard analysis and risk assessment," in *Computer Safety, Reliability, and Security: 40th International Conference, SAFECOMP 2021, York, UK, September 8–10, 2021, Proceedings 40*, pp. 178–192, Springer, 2021

- [Oakes2021] **B. Oakes**, A. Parsai., S. V. Mierlo., S. Demeyer., J. Denil., P. D. Meulenaere., and H. Vangheluwe., "Improving digital twin experience reports," in *Proceedings of the 9th International Conference on Model-Driven Engineering and Software Development - Volume 1: MODELSWARD,*, pp. 179–190, INSTICC, SciTePress, 2021

- [Moradi2020a] M. Moradi, **B. Oakes**, and J. Denil, "Machine learning-assisted fault injection," *Position paper at SAFECOMP 2020*, 2020

- [VanMierlo2020] S. Van Mierlo, **B. Oakes**, B. Van Acker, R. Eslampanah, J. Denil, and H. Vangheluwe, "Exploring validity frames in practice," in *Proceedings of the First International Conference, ICSMM 2020, Bergen, Norway, June 25–26, 2020*, pp. 131–148, Springer, Cham, 2020

- [Gomes2019] C. Gomes, **B. Oakes**, M. Moradi, A. T. Gámiz, J. C. Mendo, S. Dutré, J. Denil, and H. Vangheluwe, "HintCO – Hint-based configuration of co-simulations," in *Proceedings of the 9th International Conference on Simulation and Modeling Methodologies, Technologies and Applications - Volume 1: SIMULTECH,*, pp. 57–68, INSTICC, SciTePress, 2019. **Winner of the Best Student Paper Award**

- [Moradi2019] M. Moradi, C. Gomes, **B. Oakes**, and J. Denil, "Optimizing fault injection in FMI co-simulation through sensitivity partitioning," in *Proceedings of the 2019 Summer Simulation Conference*, SummerSim '19, (San Diego, CA, USA), pp. 1–12, Society for Computer Simulation International, 2019

- [Lucio2015] L. Lúcio, **B. Oakes**, C. Gomes, G. Selim, J. Dingel, J. Cordy, and H. Vangheluwe, "SyVOLT: Full model transformation verification using contracts," in *Model Driven Engineering Languages and Systems (MODELS)*, pp. 24–27, 2015

- [Oakes2015] **B. Oakes**, J. Troya, L. Lúcio, and M. Wimmer, "Fully verifying transformation contracts for declarative ATL," in *Model Driven Engineering Languages and Systems (MODELS)*, pp. 256–265, 2015

– [Selim2014] G. Selim, L. Lúcio, J. Cordy, J. Dingel, and **B. Oakes**, "Specification and verification of graph-based model transformation properties," in *Proceedings of International Conference on Graph Transformation*, pp. 113–129, Springer, 2014

Peer-reviewed Workshops

– [Oakes2021b] **B. Oakes**, B. Meyers, D. Janssens, and H. Vangheluwe, "Structuring and accessing knowledge for historical and streaming digital twins," in *First Workshop on Ontology-Driven Conceptual Modeling of Digital Twins*, pp. 1–13, 2021

– [Moradi2020] M. Moradi, **B. Oakes**, M. Saraoglu, A. Morozov, K. Janschek, and J. Denil, "Exploring fault parameter space using reinforcement learning-based fault injection," in *2020 50th Annual IEEE/IFIP International Conference on Dependable Systems and Networks Workshops (DSN-W)*, pp. 102–109, 2020

– [VanAcker2020] B. Van Acker, **B. Oakes**, M. Moradi, P. Demeulenaere, and J. Denil, "Validity frame concept as effort-cutting technique within the verification and validation of complex cyber-physical systems," in *Proceedings of the 23rd ACM/IEEE International Conference on Model Driven Engineering Languages and Systems: Companion Proceedings*, MODELS '20, (New York, NY, USA), Association for Computing Machinery, 2020

– [Bernaerts2019] M. Bernaerts, **B. Oakes**, K. Vanherpen, B. Aelvoet, H. Vangheluwe, and J. Denil, "Validating industrial requirements with a contract-based approach," in *2019 ACM/IEEE 22nd International Conference on Model Driven Engineering Languages and Systems Companion (MODELS-C)*, pp. 18–27, Sept. 2019

– [Meyers2019] B. Meyers, K. Gadeyne, **B. Oakes**, M. Bernaerts, H. Vangheluwe, and J. Denil, "A model-driven engineering framework to support the functional safety process," in *2019 ACM/IEEE 22nd International Conference on Model Driven Engineering Languages and Systems Companion (MODELS-C)*, pp. 619–623, Sept. 2019

– [Oakes2019] **B. Oakes**, R. Franceschini, S. Van Mierlo, and H. Vangheluwe, "The computational notebook paradigm for multi-paradigm modeling," in *2019 ACM/IEEE 22nd International Conference on Model Driven Engineering Languages and Systems Companion (MODELS-C)*, pp. 449–454, Sept. 2019

– [Oakes2018b] **B. Oakes**, C. Verbrugge, L. Lúcio, and H. Vangheluwe, "Debugging of model transformations and contracts in SyVOLT," in *Proceedings of the MDEbug Workshop at Model Driven Engineering Languages and Systems (MODELS)*, pp. 532–537, 2018

– [Selim2015] G. Selim, J. Cordy, J. Dingel, L. Lúcio, and **B. Oakes**, "Finding and fixing bugs in model transformations with formal verification: An experience report," in *Proceedings of Analysis of Model Transformations Workshop at Model Driven Engineering Languages and Systems*, pp. 26–35, 2015

Technical Reports and Theses

– [Oakes2018] **B. Oakes**, *A Symbolic Execution-Based Approach to Model Transformation Verification Using Structural Contracts*. PhD thesis, McGill University, 2018

– [Lucio2014] L. Lúcio, **B. Oakes**, and H. Vangheluwe, "A technique for symbolically verifying properties of graph-based model transformations," Tech. Rep. SOCS-TR-2014.1, McGill University, 2014

– [Oakes2014] **B. Oakes**, "Optimizing Simulink models," Tech. Rep. CS-TR-2014.5, McGill University, 2014

– [Oakes2013] **B. Oakes**, "Practical and theoretical issues of evolving behaviour trees for a turn-based game," Master's thesis, McGill University, Aug. 2013

– [Oakes2012a] **B. Oakes**, "Embedding causal block diagrams within behaviour trees," Tech. Rep. COMP 522 - Modelling and Simulation Course Project, McGill University, Apr. 2012