BENTLEY J
OAKES

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KEY ACADEMIC SKILLS SUMMARY

Researcher - Lead- and co-author of 30+ publications with 300+ 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)
Research topics: Accelerating the construction and deployment of digital twins with a knowledge-based, low-code approach. Assisting users with developing, configuring, and understanding machine learning, and verification and validation services for their DT.

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, Nov. 2023**
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.

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

Model-Driven Engineering of Digital Twins Workshop (ModDiT) **2023**
Artificial Intelligence and Model-driven Engineering Workshop (MDEIntelligence) **2023**
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

Annual Modeling and Simulation Conference (ANNSIM) **2021 to 2024**
Workshop on AI and Model-Driven Engineering (MDEIntelligence) **2022, 2023**
International Workshop on Models and Evolution **2022**
ACM Student Research Competition **2022**
Spring/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:

Journal Articles

- [Oakes2023] **B. Oakes**, M. Famelis, and H. Sahraoui, "Building domain-specific machine learning workflows: A conceptual framework for the state-of-the-practice," *ACM Trans. Softw. Eng. Methodol.*, dec 2023. Just Accepted.
- [Oakes2023b] **B. Oakes**, J. Troya, J. Galasso, and M. Wimmer, "Fault localization in dsltrans model transformations by combining symbolic execution and spectrum-based analysis," *Software and Systems Modeling*, Sep 2023
- [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. Major revision requested
- [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 *Model-Driven Engineering and Software Development, 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
- [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

- [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
- [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