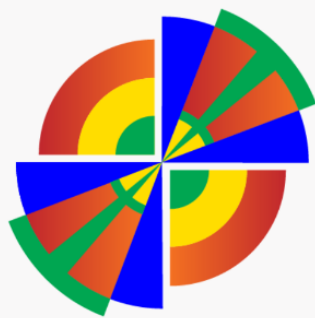




CBSOFT'25

XVI CONGRESSO BRASILEIRO DE SOFTWARE: TEORIA E PRÁTICA

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PROCEEDINGS

XXXIX Brazilian Symposium on Software Engineering

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Preface

The Brazilian Symposium on Software Engineering (SBES), annually organized by the Brazilian Computer Society (SBC), is the premier Software Engineering event in Latin America. Since 2010, SBES has been part of the Brazilian Conference on Software: Theory and Practice (CBSOFT). The CBSOFT program integrates several co-located events, fostering interaction among academics, practitioners, and students.

The technical program of SBES 2025 features three keynote speakers: (i) Lionel Briand (University of Ottawa and Lero), (ii) Sarah Nadi (New York University Abu Dhabi), and (iii) Rohit Gheyi (Universidade Federal de Campina Grande). In addition, the program presents a panel titled “*Navigating AI’s Impact on Software Quality and Production*”, with Lionel Briand, Sarah Nadi, and Armando Fox (University of California, Berkeley) as panelists, and Fabio Kon (University of São Paulo) as moderator.

In 2025, SBES received 273 valid submissions across the Research, Insightful Ideas and Emerging Results, Education, Tools, and Industry tracks. This represents an increase of more than 23% compared to the previous year, reflecting the strong and growing engagement of the Brazilian Software Engineering community. Across all tracks, each submission was reviewed by at least three Program Committee members, ensuring a rigorous and fair review process.

The **Research Track** highlights solid contributions with significant impact on the Software Engineering community, encompassing analytical, experimental (primary studies), literature reviews (secondary studies), technological, and methodological work. In 2025, 38 full papers were accepted (acceptance rate ~37%) after a rigorous double-blind review process, which included a rebuttal phase that allowed authors to clarify concerns. Evaluation criteria included originality, relevance, technical soundness, clarity of presentation, verifiability, and transparency. We thank the 111 Program Committee members and additional reviewers for their effort and dedication.

The **Insightful Ideas and Emerging Results Track** promotes innovative and inspiring ideas, as well as ongoing research with promising preliminary results, since 2015. It seeks to showcase ground-breaking early findings, approaches, and perspectives that challenge the status quo of the discipline. In 2025, 32 papers were accepted, each reviewed with respect to novelty, relevance, technical soundness, verifiability, and clarity. We are grateful to the 72 committee members for their great dedication to providing detailed and constructive feedback to the authors.

The **Education Track** publishes high-quality papers addressing challenges, innovations, and best practices in Software Engineering education, since 2017. It

welcomes contributions on curriculum development, empirical studies, experience reports, and conceptual work, aiming to advance the teaching and learning process. In 2025, 20 papers were accepted. The review process included a rebuttal phase that enabled authors to respond to reviewers' questions. We thank the 72 committee members for their valuable and timely contributions to the review process.

The **Tools Track** features innovative tools designed to support a wide range of activities across the software development lifecycle, including requirements, design, implementation, validation and verification, maintenance, and evolution. It also welcomes tools for project management, socio-economic aspects of Software Engineering, and research support (e.g., empirical studies, systematic reviews). In 2025, 22 papers were accepted. Submissions and accompanying demo videos were evaluated on relevance, soundness, and clarity. We thank the 39 reviewers for their effort and dedication.

The **Industry Track** fosters cooperation among academia, industry, and government, promoting the exchange of knowledge and experiences through papers, presentations, and discussions. In 2025, six papers were accepted, focusing on relevance, academia–industry integration, and applicability of the proposed solutions. We extend our gratitude to the nine reviewers for their constructive and detailed feedback.

Finally, the **Journal First track** offers authors of papers recently accepted in selected Software Engineering journals the opportunity to present their work at SBES. In 2025, 11 papers were selected for presentation. These papers were originally published in the *Journal of Software Engineering Research and Development* (JSERD), *Journal of Systems and Software* (JSS), *Empirical Software Engineering* (EMSE), and *Journal of Software: Evolution and Process* (JSEP).

As in previous editions, Distinguished Paper awards are granted to the best papers in each track to recognize their quality and relevance.

SBES 2025 also strongly promotes the adoption of Open Science principles and practices, encouraging transparency, replicability, and reproducibility in research. Most accepted papers shared anonymized and curated data or artifacts through appropriate repositories, ensuring permanent, citable, and public access.

Since 2019, SBES has also recognized the essential contributions of reviewers. Certificates of Outstanding Reviewer are awarded to those who provided high-quality reviews and actively engaged in the discussion process.

We warmly thank all who contributed to making this event possible. The strength of the technical program reflects the quality of submissions received from authors and

the dedication of Program Committee members and additional reviewers. We are also grateful to the SBES Steering Committee for their support. Finally, we acknowledge the outstanding work of the CBSOft 2025 organization team, led by Kiev Gama and Vinicius Garcia (both from CIn-UFPE).

We hope you enjoy the technical program of SBES 2025!

Leopoldo Teixeira & Silvia Vergilio - Research Track

Ivan Machado & Monalessa Barcellos - Insightful Ideas and Emerging Results Track

Edna Canedo & Marcelo Maia - Education Track

Cleidson de Souza & Thelma Colanzi - Tools Track

César França & Karina Kohl - Industry Track

Keynote Speakers



Automated Testing and Safety Analysis of Deep Learning Systems **Lionel Briand - University of Ottawa, Canada and Lero, Ireland**

Abstract. *Software engineering has long sought ways to enhance software testing to ensure that critical software is reliable before deployment. The advent of deep learning (DL) software has disrupted traditional testing and analysis practices, prompting the creation of specialized methods and techniques to address the unique challenges posed by DL. This is particularly crucial in critical systems with safety implications for users and the environment. This presentation will share findings from several years of research on the automation and practical testing of DL models and DL-enabled systems. It will also discuss testing-based safety analysis as an important application of testing.*

Short bio. Lionel C. Briand is a professor of software engineering with joint positions at (1) the University of Ottawa, in Canada, and (2) the Lero Centre—the Research Ireland national software research center—hosted by the University of Limerick. Over more than 30 years, in collaboration with colleagues, he has led numerous collaborative research projects with companies in the automotive, satellite, aerospace, energy, finance, and legal sectors. Lionel has held different positions as an engineer, academic, and leader in seven countries. He is currently Canada Research Chair (Tier 1) and director of Lero. Lionel was elevated to Fellow of the IEEE and the ACM for his contributions to software testing and verification. He also received the IEEE Computer Society's Harlan Mills Award, the ACM SIGSOFT Outstanding Research Award, and the IEEE Reliability Society's Engineer of the Year Award. He is a Fellow of the Royal Society of Canada and a member of Academia Europaea, the European Academy of Science. His research interests include trustworthy AI, software testing and verification (including security aspects), and requirements engineering.



Software Dependencies: Then, Now, and Beyond
Sarah Nadi - New York University Abu Dhabi, United Arab Emirates

Abstract. *Modern software development heavily relies on third-party libraries. While these dependencies accelerate development, they introduce their own set of challenges. In this talk, I will explore three common hurdles developers face and the techniques and tools that we have built to address them: comparing and selecting libraries, avoiding API misuse, and migrating to newer library versions or entirely different libraries. Then we will fast-forward to today's reality: the growing and pervasive reliance on Large Language Models (LLMs). While LLMs are helping to alleviate some of the above challenges, new advances are also redefining software dependencies and how we can ensure their correct usage, opening the door to a new set of challenges we are only beginning to understand.*

Short bio. Sarah Nadi is an Associate Professor in the Computer Science Program at New York University Abu Dhabi (NYUAD). Before joining NYUAD, she spent almost eight years at the University of Alberta in Canada where she held a Tier II Canada Research Chair in Software reuse and led the Software Maintenance and Reuse (SMR) lab. Sarah obtained her Master's (2010) and PhD (2014) degrees from the University of Waterloo in Canada and spent approximately two years as a post-doctoral researcher at the Technische Universität Darmstadt in Germany. At NYUAD, Sarah co-directs the SANAD lab whose goal is to enhance how software engineers develop and maintain software systems by providing them with the tools and insights that they need. Sarah's research expertise lies in empirical software engineering and software analytics. She has worked on a wide range of software engineering problems including finding bugs and inconsistencies in software product line, detecting insecure API usage, and leveraging LLMs for various development and maintenance tasks. Her recent work focuses on supporting developers as they use software libraries, including the initial selection process, correctly using the library's API, and potential migration to newer versions or alternative libraries.



Refactoring: Challenges, Lessons, and AI Opportunities
Rohit Gheyi - Federal University of Campina Grande, Brazil

Abstract. *Refactoring, a term introduced in the early 1990s, has become an integral part of modern software development, widely used to improve code structure while preserving behavior. However, ensuring the correctness of automated refactorings remains a challenge. In this talk, I will revisit both foundational and recent approaches to making refactoring safer, drawing on strategies such as testing, change-impact analysis, and formal verification. I will highlight contributions from our research group over the past two decades that uncovered hundreds of bugs in major IDEs. Finally, I will explore to what extent foundation models may help reshaping the landscape of software refactoring.*

Short bio. Rohit got his PhD from Federal University of Pernambuco in 2007. During the PhD, he went through an internship at Massachusetts Institute of Technology (MIT). Since 2009, he has been an associate professor in the computer science faculty at Federal University of Campina Grande (UFCG). His research group proposed a number of techniques to make program evolution safer, publishing papers in the most important SE conferences (ICSE, FSE, ICSME, SBES) and journals (TSE, EMSE, IST, JSS, TOSEM), receiving over 25 national and international awards. Since 2008, he also coordinates a project that organizes programming contests (see The Paraiba State Olympiad in Informatics), and training camps for elementary, high school, and undergraduate students in our state. UFCG students won 70+ awards in national and international programming contests. He was the recipient of the ICPC coach award in 2017.