Preface to the JOT issue on the 20th European Conference on Modelling Foundations and Applications (ECMFA 2024)

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ABSTRACT In this preface, we present an overview of the topics and scope of the European Conference on Modelling Foundations and Applications (ECMFA) and describe the editorial and reviewing process for its 20^{th} edition (ECMFA 2024). We provide an overview of the papers selected for publication and presentation and provide details about the keynote talk by Agnes Koschmider, a professor of Business Informatics at the University of Bayreuth. Finally, we acknowledge the work of the ECMFA committees.

KEYWORDS Model-Based Engineering, Modelling Foundations, Modelling Applications.

1. Introduction: About ECMFA

The European Conference on Modelling Foundations and Applications (ECMFA) serves as the premier European forum focused on advancing the state of knowledge and promoting the use of all aspects of Model-based Engineering (MBE) and related approaches. MBE involves the design, analysis, and development of software and systems relying on exploiting high-level models and computer-based automation to substantially improve both productivity and quality.

The 20^{th} ECMFA edition had two independent rounds of reviewing, starting in December and February. Authors of papers not accepted directly, had the opportunity to submit revised versions of their papers, which were reviewed again. This intended to improve the success rate and guarantee the quality of the published papers. Accepted papers of ECMFA are published in the platinum open-access journal JOT, Journal of Object Technology (http://www.jot.fm/). JOT is indexed by different organizations, including Scopus, DBLP, and Scientific Commons.

JOT reference format:
Judith Michael and Adrian Rutle. *Preface to the JOT issue on the 20th European Conference on Modelling Foundations and Applications (ECMFA 2024).* Journal of Object Technology. Vol. 23, No. 3, 2024.
http://dx.doi.org/10.5381/jot.2024.23.3.e1

ECMFA 2024 was held on July 8^{th}-9^{th} 2024 in Enschede, NL, as part of STAF 2024 (Software Technologies: Applications and Foundations).

2. Submission and review process

ECMFA 2024 solicited two types of papers presenting original research on all aspects of model-based engineering:

- Foundation Papers, dealing with modelling foundations, such as metamodelling, model transformations, model validation, verification and testing, model engineering methods and tools, and related aspects.
- Application Papers, dealing with the application of modelling techniques, including experience reports on the use of MBE methods and tools, industrial case studies, or successful applications of MBE practices in industry or in public administration, with significant modelling lessons learned. All applications must have been done in real contexts and at least one of the authors of the paper must be from the company or administration where the application took place.

No simultaneous submission to other publication outlets (either a conference or a journal) was allowed.

2.1. Topics of interest

The topics of interest for ECMFA 2024 included, but were not limited to the following:

- Foundations of MBE, including model transformations, domain-specific languages, verification and validation approaches, etc.
- Novel paradigms, formalisms, applications, approaches, frameworks, or processes for model-based engineering such as low-code/no-code development, digital twins, etc.
- Interplay between MBE with and for AI-based systems.
- Application of MBE methods, tools, and techniques to specific domains, e.g., automotive, aerospace, cyber-physical systems, robotics, Artificial Intelligence or IoT.
- Successful use of MBE in connection with other disciplines and approaches, such as Artificial Intelligence, Blockchain, DevOps, Open Source, or Safety Assurance.
- Educational aspects of MBE.
- Tools and initiatives for the successful adoption of MBE in industry.

2.2. Review criteria and process

All submissions have been peer-reviewed by at least three members of the Program Committee, who assessed them in terms of their novelty, significance, technical quality, rigor, and suitability for the conference.

Contributions could be submitted to any of the two submission rounds in December 2023 and February 2024, respectively. In both rounds, the each submitted paper could be recommended by the Program Committee to be accepted as is, accepted with minor revisions, to undergo major revisions or to be rejected.

Papers accepted at any of the two rounds with major or minor revisions were given about five weeks to perform the revisions and re-submit. The same reviewers assessed how well the revision requests have been addressed by the authors, and whether the final paper maintained or improved the level of contribution of the original submission. Revisions that significantly lessened the contribution of the work or that failed to adequately address the reviewers' original concerns resulted in the paper's rejection.

3. Accepted papers

ECMFA 2024 accepted 9 papers:

- *Automated Proof Tactics for Model Transformation* by Julien Cohen, Massimo Tisi and Rémi Douence introduces a set of automated proof tactics for the CoqTL transformation language to simplify the development of interactive proofs for model transformations, making it easier to ensure correctness for complex transformations.

- *A Variance-Based Drift Metric for Inconsistency Estimation in Model Variant Sets* by Karl Kegel, Sebastian Götz, Ronny Marx and Uwe Aßmann proposes an early warning system for merge conflicts in model-based development projects by introducing "Drift" as a metrics to quantify inconsistencies between co-existing model variants.

- *Flexible Modelling: a Systematic Literature Review* by Robbert Jongeling and Federico Ciccozzi presents an analysis of tools and approaches supporting flexible modellingand discusses open research challenges to guide future advancements in the field.

- *Integrating the Support for Machine Learning of Inter-Model Relations in Model Views* by James Pontes Miranda, Hugo Bruneliere, Massimo Tisi and Gerson Sunyé proposes a machine learning approach using Heterogeneous Graph Neural Networks (HGNNs) for inferring inter-model links within model views.

- *Towards a Semantically Useful Definition of Conformance with a Reference Model* by Marco Konersmann, Bernhard Rumpe, Max Stachon, Sebastian Stüber and Valdes Voufo defines conformance of concrete models to reference models using automated conformance checks for various kinds of software models.

- *An Empirical Study on Leveraging LLMs for Metamodels and Code Co-evolution* by Zohra Kaouter Kebaili, Djamel Eddine Khelladi, Mathieu Acher and Olivier Barais explores using Large Language Models (LLMs) to mitigate the impact of metamodel evolution on generated code by designing prompt templates that provide contextual information for code co-evolution.

- *Conflict-based Change Awareness for Collaborative Model-driven Software Engineering* by Edvin Herac, Luciano Marchezan, Wesley K. G. Assunção and Alexander Egyed proposes an approach for Collaborative Model-driven Software Engineering using an incremental growing operation tree to detect potential conflicts and filter relevant notifications.

- *A Method for Template-based Architecture Modelling and its Application to Digital Twins* by Daniel Lehner, Jérôme Pfeiffer, Stefan Klikovits, Andreas Wortmann and Manuel Wimmer describes an approach for efficiently modeling and integrating new services into digital twin architectures simplifying the extension and management of complex DT systems.

- *Modelling Variability of Hierarchical Component-Based Systems* by Nico Jansen, Jérôme Pfeiffer, Bernhard Rumpe, David Schmalzing and Andreas Wortmann proposes a modeling language for specifying the variability of hierarchically composed systems and presents a method to check the component variants' well-formedness.

4. Keynote

The keynote of the 20^{th} ECMFA edition was given on July 9^{th} by Agnes Koschmider from University of Bayreuth, Germany. Her talk with the title *"From Data Chaos to Decision Making"* provided insights from her work on process mining and process

modelling.

4.1. Abstract

This talk addresses how to efficiently process unstructured data for process mining. The volume of data is continuously increasing and the ability and demand to efficiently analyze the data has become even more crucial. Although several suitable techniques and tools already exist to efficiently process and analyze unstructured data, the challenge still exists in how to intervene in process orientation into unstructured data analysis. This combination promises to uncover new insights in terms of causal effects or bottlenecks in data that could not be directly found with alternative techniques. Finally, involving users in such an analytics pipeline gives confidence in decision-making. This talk summarizes challenges, presents use cases, and gives an outlook on prospective research projects for process mining on unstructured data.

4.2. Biography

Agnes Koschmider is a professor of Business Informatics at the University of Bayreuth, Germany. Prior to this position, Agnes Koschmider was a professor of Business Informatics at the Computer Science Institute of the University of Kiel. She completed her PhD and her habilitation in Applied Informatics at KIT. Her research focuses on methods for data-driven analysis and explanation of processes (process mining) based on artificial intelligence. At the center of her research is process analytics: developing a pipeline to efficiently process raw data (time series, sensor event data, and video data) to abstract it into process models. The application of such data pipelines can be found in many disciplines such as medicine, agricultural sciences, material sciences and marine sciences.

5. Committees

ECMFA 2024 was organized by two Program co-chairs:

- Judith Michael, RWTH Aachen University, Germany
- Adrian Rutle, Western Norway University of Applied Sciences, Norway

The Program Committee of ECMFA 2024 was composed of 40 international MBE experts from both academia and industry:

- Iván Alfonso, Luxembourg Institute of Science and Technology, LU
- Shaukat Ali, Simula Research Laboratory and Oslo Metropolitan University, NO
- Alessandra Bagnato, Softeam
- Artur Boronat, University of Leicester, UK
- Lola Burgueño, University of Malaga, ES
- Antonio Cicchetti, Mälardalen University, SE
- Federico Ciccozzi, Mälardalen University, SE
- Robert Clarisó, Universitat Oberta de Catalunya, ES
- Loek Cleophas, Eindhoven University of Technology (TU/e) and Stellenbosch University (SU)
- Benoit Combemale, University of Rennes, Inria, CNRS, IRISA, FR
- Juan de Lara, Autonomous University of Madrid, ES
- Davide Di Ruscio, University of L'Aquila, IT
- Francisco Durán, University of Málaga, ES
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- Einar Broch Johnsen, University of Oslo, NO
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- Alfonso Pierantonio, Università degli Studi dell'Aquila, IT
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- Matthias Tichy, Ulm University, DE
- Juha-Pekka Tolvanen, MetaCase, FI
- Javier Troya, Universidad de Málaga, ES
- Manuel Wimmer, JKU Linz, AT
- Haiyan Zhao, Peking University, CN
- Athanasios Zolotas, Liverpool John Moores University, UK
- Steffen Zschaler, King's College London, UK

Four additional sub-reviewers helped with the papers during the reviewing process:

- Martin Eisenberg
- Robert Jongeling
- Leo Olivier
- Adam Ziolkowski

We would like to thank Vadim Zaytsev, the STAF General Chair, and his team for hosting ECMFA 2024 in Enschede.

The ECMFA series is guided by its Steering Commitee members, namely:

- Martin Gogolla, University of Bremen, DE
- Thomas Gschwind, IBM Research Lab Zurich, CH
- Reiko Heckel, University of Leicester, UK
- Richard Paige, McMaster University, CA
- Pieter Van Gorp, Eindhoven University of Technology, NL
- Jan Vitek, Northeastern University, US

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