

2023 ACM/IEEE International Conference on Model Driven Engineering Languages and Systems Companion (MODELS-C 2023)

**Västerås, Sweden
1-6 October 2023**

Pages 1-483



**IEEE Catalog Number: CFP23V77-POD
ISBN: 979-8-3503-2499-0**

**Copyright © 2023 by the Institute of Electrical and Electronics Engineers, Inc.
All Rights Reserved**

Copyright and Reprint Permissions: Abstracting is permitted with credit to the source. Libraries are permitted to photocopy beyond the limit of U.S. copyright law for private use of patrons those articles in this volume that carry a code at the bottom of the first page, provided the per-copy fee indicated in the code is paid through Copyright Clearance Center, 222 Rosewood Drive, Danvers, MA 01923.

For other copying, reprint or republication permission, write to IEEE Copyrights Manager, IEEE Service Center, 445 Hoes Lane, Piscataway, NJ 08854. All rights reserved.

***** *This is a print representation of what appears in the IEEE Digital Library. Some format issues inherent in the e-media version may also appear in this print version.***

IEEE Catalog Number:	CFP23V77-POD
ISBN (Print-On-Demand):	979-8-3503-2499-0
ISBN (Online):	979-8-3503-2498-3

Additional Copies of This Publication Are Available From:

Curran Associates, Inc
57 Morehouse Lane
Red Hook, NY 12571 USA
Phone: (845) 758-0400
Fax: (845) 758-2633
E-mail: curran@proceedings.com
Web: www.proceedings.com

2023 ACM/IEEE International Conference on Model Driven Engineering Languages and Systems Companion (MODELS-C)

MODELS-C 2023

Table of Contents

Conference Organization	xxi
Steering Committee	xxiii

Tools and Demonstrations Track

Preface to the Tools and Demonstrations Track	1
Atlas: A Toolset for Efficient Model-Driven Data Exchange in Data Spaces	4
<i>Jakub Klímek (Charles University, Czechia), Pavel Koupil (Charles University, Czechia), Petr Škoda (Charles University, Czechia), Jáchym Bártik (Charles University, Czechia), Štěpán Stenchlák (Charles University, Czechia), Martin Nečaský (Charles University, Czechia), and Irena Holubová (Charles University, Czechia)</i>	
How MetaEdit+ Supports Co-Evolution of Modeling Languages, Tools and Models	9
<i>Steven Kelly (MetaCase, Finland) and Juha-Pekka Tolvanen (MetaCase, Finland)</i>	
Engineering Low-Code Modelling Environments with Dandelion	14
<i>Francisco Martínez-Lasaca (UGROUND, Spain), Pablo Díez (UGROUND, Spain), Esther Guerra (Universidad Autónoma de Madrid, Spain), and Juan de Lara (Universidad Autónoma de Madrid, Spain)</i>	
Designing Elasticity Policies for Cloud-Native Applications with Slingshot	19
<i>Floriment Klinaku (University of Stuttgart, Germany), Julian Katić (University of Stuttgart, Germany), Sarah Sophie Stieß (University of Stuttgart, Germany), and Steffen Becker (University of Stuttgart, Germany)</i>	

Assembly Line: A Tool for Collaborative Modeling of Ontologies in Public Administration	24
<i>Karel Klíma (Charles University in Prague, Czechia), Michal Med (Czech Technical University in Prague, Czechia), Miroslav Blaško (Czech Technical University in Prague, Czechia), Petr Křemen (Czech Technical University in Prague, Czechia), Martin Nečaský (Charles University in Prague, Czechia), Martin Ledvinka (Czech Technical University in Prague, Czechia), Alice Binderová (Czech Technical University in Prague, Czechia), Michal Švagr (Czech Technical University in Prague, Czechia), and Filip Kopecký (Czech Technical University in Prague, Czechia)</i>	
UML Miner: A Tool for Mining UML Diagrams	30
<i>Pasquale Ardimento (University of Bari Aldo Moro, Italy), Lerina Aversano (University of Sannio, Italy), Mario Luca Bernardi (University of Sannio, Italy), Vito Alessandro Carella (University of Bari Aldo Moro, Italy), Marta Cimitile (UnitelmaSapienza University, Italy), and Michele Scalera (University of Bari Aldo Moro, Italy)</i>	
MMT: Mutation Testing of Java Bytecode with Model Transformation	35
<i>Christoph Bockisch (Philipps-Universität Marburg, Germany), Gabriele Taentzer (Philipps-Universität Marburg, Germany), and Daniel Neufeld (Philipps-Universität Marburg, Germany)</i>	
Introducing bigUML: A Flexible Open-Source GLSP-Based Web Modeling Tool for UML	40
<i>Haydar Metin (TU Wien, Austria) and Dominik Bork (TU Wien, Austria)</i>	
RapidMS: A Tool for Supporting Rapid Microservices Generation and Refinement from Requirements Model	45
<i>Yang Zhang (Beihang University, China), Yang Li (Beihang University, China), Yilong Yang (Beihang University, China), Shuang Chen (China Northeast Petroleum University, China), Juntao Gao (China Northeast Petroleum University, China), Weiru Wang (Beijing University of Technology, China), and Yongfeng Yin (Beihang University, China)</i>	
RM2MS: A Tool for Automatic Identification of Microservices from Requirements Models	50
<i>Yang Li (Beihang University, China), Yang Zhang (Beihang University), Yilong Yang (Beihang University, China), Weiru Wang (Beijing University of Technology, China), and Yongfeng Yin (Beihang University, China)</i>	
jjodel - A Reflective Cloud-Based Modeling Framework	55
<i>Juri Di Rocco (Università degli Studi dell'Aquila, Italy), Davide Di Ruscio (Università degli Studi dell'Aquila, Italy), Amleto Di Salle (European University of Rome, Italy), Damiano Di Vincenzo (Università degli Studi dell'Aquila, Italy), Alfonso Pierantonio (Università degli Studi dell'Aquila, Italy), and Giordano Tinella (Università degli Studi dell'Aquila, Italy)</i>	
PyDaQu: Python Data Quality Code Generation Based on Data Architecture	60
<i>Moamin Abughazala (L'Aquila University, Italy), Henry Muccini (L'Aquila University, Italy), and Khitam Qadri (KABI Technologies, Palestine)</i>	

Gotten: A Model-Driven Solution to Engineer Domain-Specific Metamorphic Testing Environments	65
Pablo Gómez-Abajo (<i>Universidad Autónoma de Madrid, Spain</i>), Pablo C. Cañizares (<i>Universidad Autónoma de Madrid, Spain</i>), Alberto Núñez (<i>Universidad Complutense de Madrid, Spain</i>), Esther Guerra (<i>Universidad Autónoma de Madrid, Spain</i>), and Juan de Lara (<i>Universidad Autónoma de Madrid, Spain</i>)	
ScoutSL: An Open-Source Simulink Search Engine	70
Sohil Lal Shrestha (<i>University of Texas at Arlington, USA</i>), Alexander Boll (<i>University of Bern, Switzerland</i>), Timo Kehrer (<i>University of Bern, Switzerland</i>), and Christoph Csallner (<i>University of Texas at Arlington, USA</i>)	
Demonstration of the DPMF for Data Protection Analysis	75
Laurens Sion (<i>imec-DistriNet, KU Leuven, Belgium</i>), Dimitri Van Landuyt (<i>imec-DistriNet, KU Leuven, Belgium</i>), Pierre Dewitte (<i>imec-CiTIP, KU Leuven, Belgium</i>), Peggy Valcke (<i>imec-CiTIP, KU Leuven, Belgium</i>), and Wouter Joosen (<i>imec-DistriNet, KU Leuven, Belgium</i>)	

Posters Track

Preface to the Posters Track	80
MBSE Methodology to Track and Validate the Interfaces of ANDES Spectrograph for E-ELT	81
Marcello Agostino Scalera (<i>INAF - Politecnico di Milano, Italy</i>), Alessio Zanutta (<i>INAF - Politecnico di Milano, Italy</i>), and Marco Riva (<i>INAF - Politecnico di Milano, Italy</i>)	
Consistency in the View-Based Development of Cyber-Physical Systems (Convide)	83
Ralf Reussner (<i>Karlsruhe Institute of Technology, Germany</i>), Ina Schaefer (<i>Karlsruhe Institute of Technology, Germany</i>), Bernhard Beckert (<i>Karlsruhe Institute of Technology, Germany</i>), Anne Kozolek (<i>Karlsruhe Institute of Technology, Germany</i>), and Erik Burger (<i>Karlsruhe Institute of Technology, Germany</i>)	
Model Based STPA for Assisted Driving Functions	85
Bastian Olberts (<i>Continental Automotive Technologies GmbH, Germany</i>) and Yan Dittjen (<i>Continental Autonomous Mobility Germany GmbH, Germany</i>)	
Obtaining Insights Into the Interplay Between Systems and Software Engineering	87
Alexandr Vasenev (<i>TNO-ESI, The Netherlands</i>), Johan Lukkien (<i>TNO-ESI, The Netherlands</i>), Laura van Veen (<i>TNO-ESI, The Netherlands</i>), Pieter Goosen (<i>TNO-ESI, The Netherlands</i>), Richard Doornbos (<i>TNO-ESI, The Netherlands</i>), and Arjan Mooij (<i>TNO-ESI, The Netherlands; Zurich University of Applied Sciences, Switzerland</i>)	
Enlightening Modeling the Aristotelian Way with Light-Code	89
Michel Zam (<i>Paris Dauphine University-PSL; KarmicSoft, France</i>)	

Educators Symposium

Preface to the Educators Symposium	91
The Complexity Paradox: An Analysis of Modeling Education Through the Lens of Complexity Science	94
<i>Daniel Strüber (Chalmers, University of Gothenburg (SE), Radboud University Nijmegen (NL))</i>	
How Students Plagiarize Modeling Assignments	98
<i>Timur Sağlam (Karlsruhe Institute of Technology (KIT), Germany), Larissa Schmid (Karlsruhe Institute of Technology (KIT), Germany), Sebastian Hahner (Karlsruhe Institute of Technology (KIT), Germany), and Erik Burger (Karlsruhe Institute of Technology (KIT), Germany)</i>	
An Interdisciplinary Course on Model-Based Systems Engineering	102
<i>Azad Khandoker (Johannes Kepler University Linz, Austria), Sabine Sint (Johannes Kepler University Linz, Austria), Manuel Wimmer (Johannes Kepler University Linz, Austria), and Klaus Zeman (Johannes Kepler University Linz, Austria)</i>	
Generative AI in Model-Driven Software Engineering Education: Friend or Foe?	110
<i>Sergio Morales (Universitat Oberta de Catalunya, Spain), Elena Planas (Universitat Oberta de Catalunya, Spain), Robert Clarisó (Universitat Oberta de Catalunya, Spain), and Martin Gogolla (University of Bremen, Germany)</i>	
An Online Education Platform for Teaching MDE	114
<i>Will Barnett (King's College London, United Kingdom), Steffen Zschaler (King's College London, United Kingdom), Artur Boronat (University of Leicester, United Kingdom), Antonio García-Domínguez (University of York, United Kingdom), and Dimitris Kolovos (University of York, United Kingdom)</i>	
Towards Personalized Learning Paths to Empower Competence Development in Model Driven Engineering Through the ENCORE Platform	122
<i>Antonio Buccharone (Fondazione Bruno Kessler, Italy), Andrea Vázquez-Ingelmo (University of Salamanca, Spain), Gianluca Schiavo (Fondazione Bruno Kessler, Italy), Simone Barandoni (University of Pisa, Italy), Alicia García-Holgado (University of Salamanca, Spain), Francisco José García-Peña (University of Salamanca, Spain), Sébastien Mosser (McMaster University, Canada), Alfonso Pierantonio (Università degli Studi dell'Aquila, Italy), Steffen Zschaler (King's College London, UK), and William Barnett (King's College London, UK)</i>	
Using Formative Assessment and Feedback to Train Novice Modelers in Business Process Modeling	130
<i>Pavani Vemuri (KU Leuven, Belgium), Stephan Poelmans (KU Leuven, Belgium), Ivan Compagnucci (University of Camerino, Italy), and Monique Snoeck (KU Leuven, Belgium)</i>	

Doctoral Symposium

Preface to the Doctoral Symposium	138
---	-----

Towards Confidentiality in Multi-Model Inconsistency Detection for Systems Engineering	140
<i>Sebastian Bergemann (fortiss, Research Institute of the Free State of Bavaria associated with Technical University of Munich, Germany)</i>	
Runtime Monitoring of Human-Centric Requirements in Machine Learning Components: A Model-Driven Engineering Approach	146
<i>Hira Naveed (Monash University, Australia)</i>	
Towards Systematic Engineering of Hybrid Graphical-Textual Domain-Specific Languages	153
<i>Ionut Predoia (University of York, United Kingdom)</i>	
Towards Modeling and Predicting the Resilience of Ecosystems	159
<i>Tiago Sousa (University of Luxembourg, Luxembourg)</i>	
Systematic Component-Oriented Language Reuse	166
<i>Jérôme Pfeiffer (University of Stuttgart, Germany)</i>	
A Domain-Driven Model Generation Framework for Cyber-Physical Production Systems	172
<i>Mainak Majumder (LIT CPS Lab, Johannes Kepler University Linz, Austria)</i>	
A Model-Driven Platform for Engineering Holistic Digital Twins	179
<i>Daniel Lehner (Johannes Kepler University Linz, Austria)</i>	
Deriving Safety Assurance Case Argumentation from WF+ Models	186
<i>Nicholas Annable (McMaster University, Canada)</i>	
Towards Leveraging Artificial Intelligence for NoSQL Data Modeling, Querying and Quality Characterization	192
<i>Chaimae Asaad (Mohammed V University in Rabat; International University of Rabat, Morocco)</i>	

SAM 2023 - System Analysis and Modelling

Preface to the System Analysis and Modelling (SAM)	199
What Your Mother Forgot to Tell you About Modeling – and Programming	200
<i>Ole Lehrmann Madsen (Aarhus University, Denmark) and Birger Møller-Pedersen (University of Oslo, Norway)</i>	
Program Abstraction and re-Engineering: an Agile MDE Approach	211
<i>Kevin Lano (King's College London, UK), Howard Haughton (Holistic Risk Solutions Ltd, UK), Ziwen Yuan (King's College London, UK), and Hessam Alfraih (Princess Nourah bint Abdulrahman University, Saudi Arabia)</i>	
openCAESAR: Balancing Agility and Rigor in Model-Based Systems Engineering	221
<i>Maged Elaasar (NASA Jet Propulsion Lab, California Institute of Technology, USA), Nicolas Rouquette (NASA Jet Propulsion Lab, California Institute of Technology, USA), David Wagner (NASA Jet Propulsion Lab, California Institute of Technology, USA), Bentley James Oakes (DIRO, Université de Montréal; Polytechnique Montréal, Canada), Abdelwahab Hamou-Lhadj (NASA Jet Propulsion Lab, California Institute of Technology, USA; Concordia University, Canada), and Mohammad Hamdaqa (Polytechnique Montréal, Canada)</i>	
Language Agnostic Model Checking for SDL	231
<i>Emmanuel Gaudin (PragmaDev, France), Eric Brunel (PragmaDev, France), and Mihal Brumbulli (PragmaDev, France)</i>	

Towards Memory-Efficient Validation of Large XMI Models	241
<i>Sorour Jahanbin (University of York, United Kingdom), Dimitris Kolovos (University of York, United Kingdom), and Simos Gerasimou (University of York, United Kingdom)</i>	
Towards SysML v2 as a Variability Modeling Language	251
<i>Jordan Epp (University of Toronto, Canada), Thomas Robert (Safran Landing Systems, Canada), Olivier Ruch (Safran Landing Systems, Canada), and Alison Olechowski (University of Toronto, Canada)</i>	
On the Conceptualization of Tools for Traceabilitybased Change Impact Analysis using a Domainspecific Modeling Approach	257
<i>Afef Awadid (Technological Research Institute SystemX, France) and Remi Boyer (Technological Research Institute SystemX, France)</i>	
A Domain-Specific Language for Monitoring ML Model Performance	266
<i>Panagiotis Kourouklidis (University of York, British Telecom, United Kingdom), Dimitris Kolovos (University of York, United Kingdom), Joost Noppen (British Telecom, United Kingdom), and Nicholas Matragkas (Université Paris-Saclay, France)</i>	
Automated Provenance Collection at Runtime as a Cross-Cutting Concern	276
<i>Owen James Reynolds (Aston University, UK), Antonio García-Domínguez (University of York, UK), and Nelly Bencomo (Durham University, UK)</i>	
Trends and Insights into the Use of Model-Driven Engineering: A Survey	286
<i>Hessa Alfraihi (Princess Nourah bint Abdulrahman University, Saudi Arabia) and Kevin Lano (King's College London, UK)</i>	
IoTMoF: A Requirements-Driven Modelling Framework for IoT Systems	296
<i>Paul Boutot (Toronto Metropolitan University, Canada) and Sadaf Mustafiz (Toronto Metropolitan University, Canada)</i>	
Using Goal-Oriented Requirements Language for Modelling ISO 31000 Asset-Based Approach	306
<i>Naif Abdullah M. Alzahrani (AL-Baha University, Saudi Arabia), Edna Braun (Ottawa, Canada), Ruba S. Skaik (Quality Assurance Environment & Climate Change, Canada), and Mohammad Alhaj (Ottawa, Canada)</i>	
Towards Requirements Specification Collaboration Forum for Embedded Software Systems	312
<i>Asma Fariha (Ontario Tech University, Canada), Sanaa Alwidian (Ontario Tech University, Canada), and Akramul Azim (Ontario Tech University, Canada)</i>	
Detection of Linguistic Bad Smells in GRL Models: An NLP Approach	318
<i>Nouf Alturayefi (KFUPM; Imam Abdurahman Bin Faisal University, Saudi Arabia) and Jameleddine Hassine (KFUPM, Saudi Arabia)</i>	

Modeling Language Engineering (MLE) Workshop

Preface to the Modeling Language Engineering Workshop (MLE)	328
User-Centric Model-Aware Recommendations for Industrial Domain-Specific Modelling Languages	330
<i>Rohit Gupta (Siemens AG, Germany), Nico Jansen (RWTH Aachen University, Germany), Nikolaus Regnat (Siemens AG, Germany), and Bernhard Rümpe (RWTH Aachen University, Germany)</i>	

Enhancing Gameful Systems with a Domain Specific Language for Rules Lifecycle Management ...	342
<i>Antonio Buccharone (Fondazione Bruno Kessler (FBK), Italy), Stefano Martella (University of L'Aquila, Italy), Mario Fusco (Red Hat, Italy), and Henry Muccini (University of L'Aquila, Italy)</i>	
On the Suitability of LSP and DAP for Domain-Specific Languages	353
<i>Josselin Enet (Nantes Université, École Centrale Nantes, IMT Atlantique, CNRS, France), Erwan Bousse (Nantes Université, École Centrale Nantes, IMT Atlantique, CNRS, France), Massimo Tisi (Nantes Université, École Centrale Nantes, IMT Atlantique, CNRS, France), and Gerson Sunyé (Nantes Université, École Centrale Nantes, IMT Atlantique, CNRS, France)</i>	
Collaborative Live Modelling by Language-Agnostic Versioning	364
<i>Joeri Exelmans (University of Antwerp, Belgium), Ciprian Teodorov (ENSTA Bretagne, France), Robert Heinrich (Karlsruhe Institute of Technology, Germany), Alexander Egyed (Johannes Kepler University, Austria), and Hans Vangheluwe (University of Antwerp – Flanders Make, Belgium)</i>	
Monitoring Association Constraints in Model-Oriented Programming	375
<i>Sylvain Guérin (ENSTA Bretagne, France), Joel Champeau (ENSTA Bretagne, France), Antoine Beugnard (IMT Atlantique, France), and Salvador Martínez (IMT Atlantique, France)</i>	
Towards an End-to-End Metamodeling Approach Using Rust	381
<i>Léo Olivier (Université Paris-Saclay, CEA, LIST, France), Marcos Didonet Del Fabro (Université Paris-Saclay, CEA, LIST, France), Chokri Mraidha (Université Paris-Saclay, CEA, LIST, France), and Sébastien Gérard (Université Paris-Saclay, CEA, LIST, France)</i>	

International Workshop on OCL and Textual Modeling (OCL'2023)

Preface to the International Workshop on OCL and Textual Modeling (OCL)	391
Specifying Temporal Properties in UML Using Patterns: A Tool-Supported Approach	393
<i>Hector Cardenas (Texas A&M International University) and Mustafa Al Lail (Texas A&M International University)</i>	
Model-Driven Approach for Automatic Model Information Aggregation in Structured Documents	
403	
<i>Arne Henzgen (Fraunhofer FOKUS, Germany) and Lukas Strey (Fraunhofer FOKUS, Germany)</i>	
Approaching Model Edition as a Linear Logic Problem	414
<i>Frédéric Jouault (University of Angers & ESEO-TECH, France) and Nicolas Pouillard (STACK'S, France)</i>	
Towards a Model Development Environment Acknowledging Contradicting Dimensions in MDE	422
<i>Martin Gogolla (University of Bremen, Germany)</i>	

MoDDiT'23: 3rd International Workshop on Model-Driven Engineering for Digital Twins

Preface to the 3rd International Workshop on Model-Driven Engineering for Digital Twins (MoDDiT)	426
Model-Based DevOps: Foundations and Challenges	429
<i>Benoit Combemale (University of Rennes 1, France), Jean-Marc Jézéquel (University of Rennes 1, France), Quentin Perez (University of Rennes 1, France), Didier Vojtisek (University of Rennes 1, France), Nico Jansen (RWTH Aachen University, Germany), Judith Michael (RWTH Aachen University, Germany), Florian Rademacher (RWTH Aachen University, Germany), Bernhard Rumpe (RWTH Aachen University, Germany), Andreas Wortmann (University of Stuttgart, Germany), and Jingxi Zhang (University of Stuttgart, Germany)</i>	
Extracting Hardware Reconfiguration Models Based on Knowledge Synthesis from STEP Files	434
<i>Birte Caesar (Helmut-Schmidt-University, Germany), Nico Jansen (RWTH Aachen University, Germany), Maximilian Weigand (Helmut-Schmidt-University, Germany), Alexander Fay (Helmut-Schmidt-University, Germany), and Bernhard Rumpe (RWTH Aachen University, Germany)</i>	
Towards Ontology Enabled Agent-Based Twinning for Cyber-Physical Systems	444
<i>Hussein Marah (University of Antwerp & Flanders Make Strategic Research Center, Belgium), Lucas Lima (University of Antwerp & Flanders Make Strategic Research Center, Belgium; Universidade Federal Rural de Pernambuco, Brazil), Moharram Challenger (University of Antwerp & Flanders Make Strategic Research Center, Belgium), and Hans Vangheluwe (University of Antwerp & Flanders Make Strategic Research Center, Belgium)</i>	
Supporting Digital Twins Systems Integrating the MERODE Approach	449
<i>Ivan Compagnucci (University of Camerino, Italy), Monique Snoeck (KU Leuven, Belgium), and Estefanía Serral Asensio (KU Leuven, Belgium)</i>	
Towards Generating Model-Driven Speech Interfaces for Digital Twins	459
<i>Ramya Jayaraman (Johannes Kepler University Linz, Austria), Daniel Lehner (Johannes Kepler University Linz, Austria), Stefan Klikovits (Johannes Kepler University Linz, Austria), and Manuel Wimmer (Johannes Kepler University Linz, Austria)</i>	
A Model-Driven Digital Twin for Manufacturing Process Adaptation	465
<i>Patrick Spaney (University of Stuttgart, ISTE, Germany), Steffen Becker (University of Stuttgart, ISTE, Germany), Robin Ströbel (Karlsruhe Institute of Technology, wbk, Germany), Jürgen Fleischer (Karlsruhe Institute of Technology, wbk, Germany), Soraya Zenhari (University of Stuttgart, IfW, Germany), Hans-Christian Möhring (University of Stuttgart, IfW, Germany), Ann-Kathrin Splettstößer (University of Stuttgart, ISW, Germany), and Andreas Wortmann (University of Stuttgart, ISW, Germany)</i>	

Challenges of Integrating Model-Based Digital Twins for Vehicle Diagnosis	470
<i>Malte Heithoff (RWTH Aachen University, Germany), Marco Konersmann (RWTH Aachen University, Germany), Judith Michael (RWTH Aachen University, Germany), Bernhard Rumpe (RWTH Aachen University, Germany), and Felix Steinfurth (RWTH Aachen University, Germany)</i>	

A Modeling Approach Supporting Digital Twin Engineering: Optimizing the Energy Consumption of Air Conditioning Facilities	479
<i>Benjamin Nast (University of Rostock, Germany), Achim Reiz (University of Rostock, Germany), Nikola Ivanovic (University of Rostock, Germany), and Kurt Sandkuhl (University of Rostock, Germany)</i>	

5th International Workshop on Multi-Paradigm Modeling for Cyber- Physical Systems (MPM4CPS)

Preface to the 5th International Workshop on Multi-Paradigm Modeling for Cyber-Physical Systems (MPM4CPS)	484
Weaving System-Level Properties with Architectural Decomposition for Mechatronic Co-Design... 486	
<i>Milan Cornelis (University of Antwerp, Flanders Make, Belgium), Yon Vanommeslaeghe (University of Antwerp, Flanders Make, Belgium), Bert Van Acker (University of Antwerp, Flanders Make, Belgium), and Paul De Meulenaere (University of Antwerp, Flanders Make, Belgium)</i>	
Towards Continuous Verification and Validation of Multi-Domain System Designs	495
<i>Yon Vanommeslaeghe (University of Antwerp, Flanders Make, Belgium), Bert Van Acker (University of Antwerp, Flanders Make, Belgium), Milan Cornelis (University of Antwerp, Flanders Make, Belgium), and Paul De Meulenaere (University of Antwerp, Flanders Make, Belgium)</i>	
Qualitative Tendencies for Hybrid System Simulation	500
<i>Baptiste Gueuzie (Université Paris-Saclay, CEA, List, France), Jean-Pierre Gallois (Université Paris-Saclay, CEA, List, France), and Frédéric Boulanger (Université Paris-Saclay, CNRS, CentraleSupélec, Laboratoire Méthodes Formelles, France)</i>	
Barriers for Adopting FMI-Based Co-Simulation in Industrial MBSE Processes	510
<i>Johan Cederbladh (Mälardalen University; Volvo Construction Equipment, Sweden), Anna Reale (Dynatrace, Austria), Andreas Bergsten (Alstom, Sweden), Richard Mikelöv (SAAB Aeronautics, Sweden), and Antonio Cicchetti (Mälardalen University, Sweden)</i>	
Supporting Early-Safety Analysis of IoT Systems by Exploiting Testing Techniques	520
<i>Diego Clerissi (University of Milano-Bicocca, Italy), Juri Di Rocco (University of l'Aquila, Italy), Davide Di Ruscio (University of l'Aquila, Italy), Claudio Di Sipio (University of l'Aquila, Italy), Felicien Ibirwe (University of l'Aquila, Italy), Leonardo Mariani (University of Milano-Bicocca, Italy), Daniela Micucci (University of Milano-Bicocca, Italy), Maria Teresa Rossi (University of Milano-Bicocca, Italy), and Riccardo Ruberti (University of l'Aquila, Italy)</i>	

A Multi-Robot Warehouse System: An Exemplar	530
<i>Hussein Marah (University of Antwerp & Flanders Make Strategic Research Center, Belgium), Randy Paredis (University of Antwerp & Flanders Make Strategic Research Center, Belgium), Moharram Challenger (University of Antwerp & Flanders Make Strategic Research Center, Belgium), and Hans Vangheluwe (University of Antwerp & Flanders Make Strategic Research Center, Belgium)</i>	
ResyDuo: Combining Data Models and CF-Based Recommender Systems to Develop Arduino Projects	539
<i>Juri Di Rocco (University of L'Aquila, Italy) and Claudio Di Sipio (University of L'Aquila, Italy)</i>	
Towards a Development Process for Multi-CPU Distributed Synchronous Software Applications ..	549
<i>Eric Lubat (IRT Saint-Exupéry, France), Eric Jenn (IRT Saint-Exupéry, France), Dominique Blouin (LTCI, Telecom Paris, Institut Polytechnique de Paris, France), and Marc Kaufmann (Safran Electronics & Defense, France)</i>	

MDE Intelligence: 5th Workshop on Artificial Intelligence and Model-driven Engineering

Preface to the 5th Workshop on Artificial Intelligence and Model-Driven Engineering (MDE Intelligence)	559
Encoding Conceptual Models for Machine Learning: A Systematic Review	562
<i>Syed Juned Ali (TU Wien), Aleksandar Gavric (TU Wien), Henderik Proper (TU Wien), and Dominik Bork (TU Wien)</i>	
Model-Driven Optimization: Towards Performance-Enhancing Low-Level Encodings	571
<i>Lars van Arragon (Radboud University Nijmegen (NL)), Carlos Diego Damasceno (Radboud University Nijmegen (NL)), and Daniel Strüber (Chalmers, University of Gothenburg (SE), Radboud University Nijmegen (NL))</i>	
Extracting Domain Models from Textual Requirements in the Era of Large Language Models	580
<i>Sathurshan Arulmohan (McMaster University, CAS & McSCert, Canada), Marie-Jean Meurs (Université du Québec à Montréal, CIRST, Canada), and Sébastien Mosser (McMaster University, CAS & McSCert, Canada)</i>	
Prompting or Fine-tuning? A Comparative Study of Large Language Models for Taxonomy Construction	588
<i>Boqi Chen (McGill University, Canada), Fandi Yi (McGill University, Canada), and Dániel Varró (Linköping University, Sweden; McGill University, Canada)</i>	
Towards Generating Structurally Realistic Models by Generative Adversarial Networks	597
<i>Abbas Rahimi (Johannes Kepler University, Austria; University of Isfahan, Iran), Massimo Tisi (IMT Atlantique, France), Shekoufeh Kolahdouz Rahimi (University of Roehampton, United Kingdom; University of Isfahan, Iran), and Luca Berardinelli (Johannes Kepler University, Austria)</i>	

NEURAL-UML: Intelligent Recognition System of Structural Elements in UML Class Diagram	605
<i>Aymeric Koenig (IMT Nord Europe, Institut Mines-Télécom, Univ. Lille, Centre for Digital Systems, France), Benjamin Allaert (IMT Nord Europe, Institut Mines-Télécom, Univ. Lille, Centre for Digital Systems, France), and Emmanuel Renaux (IMT Nord Europe, Institut Mines-Télécom, Univ. Lille, Centre for Digital Systems, France)</i>	
Model-Driven Optimization for Quantum Program Synthesis with MOMoT	614
<i>Felix Gemeinhardt (Johannes Kepler University Linz, Austria), Martin Eisenberg (Johannes Kepler University Linz, Austria), Stefan Klikovits (Johannes Kepler University Linz, Austria), and Manuel Wimmer (Johannes Kepler University Linz, Austria)</i>	
Towards Understanding and Analyzing Rationale in Commit Messages Using a Knowledge Graph Approach	622
<i>Mouna Dhaouadi (Université de Montréal, Canada), Bentley James Oakes (DIRO, Université de Montréal; GIGL, Polytechnique Montréal, Canada), and Michalis Famelis (Université de Montréal, Canada)</i>	

10th International Workshop on Multi-Level Modeling (MULTI 2023)

Preface to the 10th International Workshop on Multi-Level Modeling (MULTI)	631
An Ontological View on Types	634
<i>Giancarlo Guizzardi (University of Twente, The Netherlands)</i>	
Clabject Typing in MLM – the Double Life of a Clabject A Position Paper	635
<i>Mira Balaban (Ben-Gurion University of the Negev, ISRAEL), Michael Kifer (Stony Brook University, USA), and Azzam Maraee (Achva Academic College, ISRAEL)</i>	
Field Types for Deep Characterization in Multi-Level Modeling	639
<i>Thomas Kühne (Victoria University of Wellington, New Zealand), João Paulo A. Almeida (Federal University of Espírito Santo (UFES), Brazil), Colin Atkinson (University of Mannheim, Germany), Manfred A. Jeusfeld (University of Skövde, Sweden), and Gergely Mezei (Budapest University of Technology and Economics, Hungary)</i>	
Modeling in LML with DOCL	649
<i>Arne Lange (University of Mannheim, Germany) and Colin Atkinson (University of Mannheim, Germany)</i>	
Modeling Facets of a Warehouse with the FMMLX: A Contribution to the MULTI Warehouse Challenge	659
<i>Ulrich Frank (University of Duisburg-Essen, Germany), Pierre Maier (University of Duisburg-Essen, Germany), and Daniel Töpel (University of Duisburg-Essen, Germany)</i>	
Comparing LML and FMMLX	669
<i>Arne Lange (University of Mannheim, Germany), Ulrich Frank (University of Duisburg-Essen, Germany), Colin Atkinson (University of Mannheim, Germany), and Daniel Töpel (University of Duisburg-Essen, Germany)</i>	

Towards the Integration of Multi-Level and Multi-View Modelling for Interoperability	679
<i>Yuhong Fu (University of South Australia; Future Energy Exports Cooperative Research Centre, Australia), Georg Grossmann (University of South Australia; Future Energy Exports Cooperative Research Centre, Australia), Karamjit Kaur (University of South Australia; Future Energy Exports Cooperative Research Centre, Australia), Matt Selway (University of South Australia; Future Energy Exports Cooperative Research Centre, Australia), and Markus Stumptner (University of South Australia; Future Energy Exports Cooperative Research Centre, Australia)</i>	
Using Multilevel Business Artifacts for Knowledge Management in Analytics Projects	689
<i>Simon Staudinger (Johannes Kepler University Linz, Austria), Christoph G. Schuetz (Johannes Kepler University Linz, Austria), and Michael Schreifl (Johannes Kepler University Linz, Austria)</i>	
The MULTI Warehouse Challenge	699
<i>Thomas Kühne (Victoria University of Wellington, New Zealand) and Manfred A. Jeusfeld (University of Skövde, IIT, Sweden)</i>	

1st Workshop on Model-based Systems Engineering

Preface to the 1st Workshop on Model-based Systems Engineering (MBSE)	703
Mastering Reference Architectures with Modeling Assistants	705
<i>Amleto Di Salle (European University of Rome, Italy), Ludovico Iovino (Gran Sasso Science Institute, Italy), and Leonardo Mariani (Università degli Studi di Milano-Bicocca, Italy)</i>	
MBSE Tool Selection Process: Feedback from a Railway Case Study	710
<i>Christophe Ponsard (CETIC, Belgium) and Denis Darquennes (CETIC, Belgium)</i>	
An Automotive Architecture Product Line for E/E Powertrain Architectures	715
<i>Horacio Hoyos Rodriguez (McMaster University, Canada), Naveen Ganesh Muralidharan (McMaster University, Canada), Faezeh Siavashi (McMaster University, Canada), Vera Pantelic (McMaster University, Canada), Victor Bandur (McMaster University, Canada), Mark Lawford (McMaster University, Canada), and Richard F. Paige (McMaster University, Canada)</i>	
EasyMOD: a Web-Based Modeling Tool for Non-MBSE Engineers	720
<i>Jean-Marie Gauthier (IRT Saint Exupéry, France), Jérôme Fasquel (IRT Saint Exupéry, France), and Julien Baclet (IRT Saint Exupéry, France)</i>	
Symbolic Reasoning for Early Decision-Making in Model-Based Systems Engineering	721
<i>Johan Cederbladh (Mälardalen University; Volvo Construction Equipment, Sweden), Loek Cleophas (Eindhoven University of Technology, The Netherlands; Stellenbosch University, South Africa), Eduard Kamburjan (University of Oslo), Lucas Lima (Universidade Federal Rural de Pernambuco; University of Antwerp and Flanders Make), and Hans Vangheluwe (University of Antwerp; Flanders Make)</i>	

7th International Workshop on Human Factors in Modeling / Modeling of Human Factors (HuFaMo' 23)

Preface to the 7th International Workshop on Human Factors in Modeling / Modeling of Human Factors (HuFaMo)	726
COMET: A ML-Based Tool for Evaluating the Effectiveness of Software Design Communication ...	729
<i>Marcus Haapasaari Lindgren (Mid Sweden University, Sweden), Jon Persson (Mid Sweden University, Sweden), Rodi Jolak (Mid Sweden University, Sweden), and Felix Dobslaw (Mid Sweden University, Sweden)</i>	
Unveiling Developers' Mindset Barriers to Software Modeling Adoption	737
<i>Reyhaneh Kalantari (University of Ottawa, Canada) and Timothy C. Lethbridge (University of Ottawa, Canada)</i>	
Challenging Models: Formalizing Quests in Gamified Systems for Behavioral Change	747
<i>Federico Bonetti (Fondazione Bruno Kessler, Italy), Antonio Buccharone (Fondazione Bruno Kessler, Italy), Antonio Cicchetti (Mälardalen University, Sweden), and Annapaola Marconi (Fondazione Bruno Kessler, Italy)</i>	
Task Models as a Mean to Identify and Justify Automations in Development Tasks	757
<i>Axel Carayon (ICS-IRIT, Université Toulouse III - Paul Sabatier, France), Célia Martinie (ICS-IRIT, Université Toulouse III - Paul Sabatier, France), and Philippe Palanque (ICS-IRIT, Université Toulouse III - Paul Sabatier, France)</i>	

2nd International Hands-on Workshop on Collaborative Modeling (HoWCoM)

Preface to the 2nd International Hands-on Workshop on Collaborative Modeling (HoWCoM)	765
Collaboration And Versioning Framework – a Systematic Top-Down Approach	767
<i>Jakob Pietron (Ulm University, Germany), Alexander Raschke (Ulm University, Germany), Joeri Exelmans (University of Antwerp – Flanders Make, Belgium), and Matthias Tichy (Ulm University, Germany)</i>	

MoDeVVa'23: Model Driven Engineering, Verification and Validation

Preface to the Model Driven Engineering, Verification and Validation (MoDeVVa)	778
Qualitative Reasoning and Cyber-Physical Systems: Abstraction, Modeling, and Optimized Simulation	781
<i>Baptiste Gueuziec (Université Paris-Saclay, CEA, List, France), Jean-Pierre Gallois (Université Paris-Saclay, CEA, List, France), and Frédéric Boulanger (Université Paris-Saclay, CNRS, CentraleSupélec, Laboratoire Méthodes Formelles, France)</i>	

DiNeROS: A Model-Driven Framework for Verifiable ROS Applications with Petri Nets	791
<i>Sebastian Ebert (Centre for Tactile Internet with Human-in-the-Loop (CeTI), Technische Universität Dresden, Germany), Johannes Mey (Technische Universität Dresden, Germany), René Schöne (6G-life, Technische Universität Dresden), Sebastian Götz (Technische Universität Dresden, Germany), and Uwe Afsmann (Centre for Tactile Internet with Human-in-the-Loop (CeTI), 6G-life, Technische Universität Dresden, Germany)</i>	
Towards an Ontological Framework for Validity Frames	801
<i>Rakshit Mittal (University of Antwerp - Flanders Make, Belgium), Raheleh Eslampanah (University of Antwerp - Flanders Make, Belgium), Lucas Lima (University of Antwerp - Flanders Make, Belgium; Universidade Federal Rural de Pernambuco, Brazil), Hans Vangheluwe (University of Antwerp - Flanders Make, Belgium), and Dominique Blouin (Telecom Paris, Institut Polytechnique de Paris, France)</i>	
Towards an Extensible Architecture and Tool Support for Model-Based Verification	806
<i>David Delgado (Universidad de Málaga, Spain), Lola Burgueño (ITIS Software, Universidad de Málaga, Spain), Javier Cámará (ITIS Software, Universidad de Málaga, Spain), and Javier Troya (ITIS Software, Universidad de Málaga, Spain)</i>	
Debugging Paxos in the UML Multiverse	811
<i>Matthias Pasquier (Ertsgener, France), Ciprian Teodorov (ENSTA Bretagne, France), Frédéric Jouault (ESEO, France), Matthias Brun (ESEO, France), and Loïc Lagadec (ENSTA Bretagne, France)</i>	
Applicability of the ViMoTest Approach for Automated GUI Testing: A Field Study	821
<i>Mario Fuksa (University of Stuttgart, Germany), Sandro Speth (University of Stuttgart, Germany), and Steffen Becker (University of Stuttgart, Germany)</i>	
Empowering Model Repair: A Rule-Based Approach to Graph Repair Without Side Effects	831
<i>Alexander Lauer (Philipps-Universität Marburg, Germany), Jens Kosiol (Philipps-Universität Marburg, Germany), and Gabriele Taentzer (Philipps-Universität Marburg, Germany)</i>	
Automated Mitigation of Frame Problem in UML Class Diagram Verification	841
<i>Antonio Rosales Viesca (Texas A&M International University, USA) and Mustafa Al Lail (Texas A&M International University, USA)</i>	

4th International Workshop on Modeling in Low-Code Development Platforms

Preface to the 4th International Workshop on Modeling in Low-Code Development Platforms (LowCode)	851
Navigating the Low-Code Landscape: A Comparison of Development Platforms	854
<i>Jörg Christian Kirchhof (RWTH Aachen University, acronio GmbH, Germany), Nico Jansen (RWTH Aachen University, acronio GmbH, Germany), Bernhard Rumpe (RWTH Aachen University, acronio GmbH, Germany), and Andreas Wortmann (University of Stuttgart, Germany)</i>	

Performance and Scalability of DMN-Based LCNC Platforms	863
<i>Octavian Patrascoiu (Goldman Sachs, United Kingdom)</i>	
Model and Data Differences in an Enterprise Low-Code Platform	868
<i>Arvid Butting (mgm technology partners gmbh, Germany), Timo Greifenberg (mgm technology partners gmbh, Germany), Katrin Hölldobler (mgm technology partners gmbh, Germany), and Timo Kehrer (University of Bern, Switzerland)</i>	
In Search of The Essence of No-Code – Elements of Data Modeling	878
<i>Jean-Marie Favre (University Grenoble Alpes, France), Raquel Araújo de Oliveira (University Grenoble Alpes, France), Jean-Sébastien Sottet (LIST, Luxembourg), and Marc Quast (STMicroelectronics, France)</i>	
A Low-Code Approach for Data View Extraction from Engineering Models with GraphQL	888
<i>István Koren (RWTH Aachen University), Nico Jansen (RWTH Aachen University), Judith Michael (RWTH Aachen University), Bernhard Rumpf (RWTH Aachen University), and Enno Böse (RWTH Aachen University)</i>	
Bridging Workflow Automation Tools and EMF Modeling Ecosystems	893
<i>Adiel Tuyishime (Gran Sasso Science Institute, Italy), Francesco Basciani (Gran Sasso Science Institute, Italy), Ludovico Iovino (Gran Sasso Science Institute, Italy), Javier Luis Cánovas Izquierdo (IN3 – UOC, Spain), Jordi Cabot (Luxembourg Institute of Science and Technology, Luxembourg), and Alfonso Pierantonio (University of L'Aquila, Italy)</i>	
Readly - Books Rating Low-Code Platform	898
<i>Bruno Nascimento (Instituto Politécnico de Viseu, Portugal), Rui Santos (Instituto Politécnico de Viseu, Portugal), Steven Abrantes (Instituto Politécnico de Viseu, Portugal), and Carlos Quental (Instituto Politécnico de Viseu, Portugal)</i>	
A Performant Low-Code System for the Timely Implementation of Road Safety Regulations	906
<i>Lars Westermann (FSD - Central Agency for PTI, Germany), Johannes Mey (6G-life, Technische Universität Dresden, Germany), René Schöne (6G-life, Technische Universität Dresden, Germany), and Uwe Aßmann (6G-life, Technische Universität Dresden, Germany)</i>	

International Workshop on Models and Evolution 2023: Sustainability

Preface to the International Workshop on Models and Evolution 2023: Sustainability (ME)	911
Evaluating Tool Support for Co-Evolution of Modeling Languages, Tools and Models	914
<i>Juha-Pekka Tolvanen (MetaCase, Finland) and Steven Kelly (MetaCase, Finland)</i>	
Towards an Interoperable Textual Format for Model Differences Reporting	924
<i>Alfonso de la Vega (Universidad de Cantabria, Spain)</i>	
Towards Modeling Process Mining for Graphical Editors	929
<i>MohammadHadi Dehghani (Johannes Kepler University, Austria), Luca Berardinelli (Johannes Kepler University, Austria), and Manuel Wimmer (Johannes Kepler University, Austria)</i>	

Towards a Taxonomy of Digital Twin Evolution for Technical Sustainability	934
<i>Istvan David (McMaster University, Canada) and Dominik Bork (TU Wien, Austria)</i>	
Towards Evolving Secured Multi-Model Systems with Model Federation	939
<i>Chahrazed Boudjemila (IMT Atlantique, Lab-STICC, France), Fabien Dagnat (IMT Atlantique, Lab-STICC, France), and Salvador Martínez (IMT Atlantique, Lab-STICC, France)</i>	
Automating Feature Requests for User-Driven Model Evolution at Runtime	944
<i>Karl Kegel (Technische Universität Dresden, Germany)</i>	
Co-Evolving Meta-Models and View Types in View-Based Development	954
<i>Hossain Muhammad Muctadir (Eindhoven University of Technology (TU/e), The Netherlands), Lars König (Karlsruhe Institute of Technology (KIT), Germany), Thomas Weber (Karlsruhe Institute of Technology (KIT), Germany), Moussa Amrani (University of Namur, Belgium), and Loek Cleophas (Eindhoven University of Technology (TU/e), The Netherlands; Stellenbosch University, South Africa)</i>	
Enabling Informed Sustainability Decisions: Sustainability Assessment in Iterative System Modeling	964
<i>Gabriele Gramelsberger (RWTH Aachen University), Hendrik Kausch (RWTH Aachen University), Judith Michael (RWTH Aachen University), Frank Piller (RWTH Aachen University), Ferdinand Ponci (RWTH Aachen University), Aaron Praktikno (RWTH Aachen University), Bernhard Rumpe (RWTH Aachen University), Rega Sota (RWTH Aachen University), and Sandra Venghaus (RWTH Aachen University)</i>	
Efficient Caching for Operation-Based Versioning	969
<i>Jakob Pietron (Ulm University, Germany), Heiko Raab (Ulm University, Germany), and Matthias Tichy (Ulm University, Germany)</i>	

Author Index