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Preface
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4 pages
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Multi-Paradigm Modelling (MPM) is a research field focused on solving the challenge of combining, coupling, and integrating rigorous models of some reality, at different levels of abstraction and views, using adequate modelling formalisms and semantic domains, with the goal to simulate (for optimization) or realize systems that may be physical, software or a combination of both. Ultimately this research should lead to a unified discipline with supporting tools and clear systematic approaches. The key challenges are finding adequate Model Abstractions, Multi-formalism modelling, Model Transformation and the application of MPM techniques and tools to Complex Systems. MPM theories/methods/technologies have been successfully applied in the field of software architectures, control system design, model integrated computing, and tool interoperability.

This volume of ECEASST presents the contributions of the 4th Workshop on Multi-Paradigm Modelling 2010 held as a satellite event of MoDELS 2010 in Oslo, Norway. Confirming the tendency of previous editions, the workshop has experienced a steady growth. More than 40 people have participated in this workshop. Reflecting the nature of MPM, the audience was composed of researchers from diverse fields of research ranging from theoretical Computer Science to domain-experts (cybernetics, mechanical engineering, embedded systems, . . . ). This variety led to productive cross-disciplinary discussions. This years workshop had 18 submissions. The review process counted with 3 to 5 reviewers per paper. Eight contributions were accepted as full papers with a presentation time of 20 minutes and five were considered short papers with 15 minutes presentations. From the reviews, both the high quality of the contributions and the progress made during the last year in MPM research were visible. The papers presented at the workshop approached a wide range of topics within MPMs concerns as we will summarize in the next page.
Megamodelling - The topic of Megamodels (or macromodels) first introduced by Favre and Bzivin is surveyed in the paper by Hebig, Seibel and Giese that proposes its core definition.

Transformations The work by Asztalos, Syriani, Wimmer and Kessentini (one of the two best papers award) focused on the issue of transformation rule composition. The authors discuss the possibility of generating a single transformation derived from a chain of transformations in the context of PIM and PSM models when model evolution occurs. An example application presented is the transformation of UML models into EJB 2.0 and then to EJB 3.0. There was also in this workshop a work by Aranega, V., Etien, A., Dekeyser, that highlights the limitations of the traceability mechanism of QVT through different scenarios.

Model Debugging - The paper by T. Levendovsky presents a novel way to develop model transformations in an interactive fashion, where the modeller is able to select the model elements for the transformation, pause the transformation engine at run-time, analyse its results, and even change the matched patterns for the further transformation steps. This technique can be very useful for refactoring operations and application of design patterns.

Verification and Optimization - The paper by Kerzhner and Paredis (one of the two best papers award) presents a discussion on how to verify and optimize design alternatives with respect to system Engineering design requirements. This is achieved by means of automated generation of analyses from formal models expressed in OMG SysUML on the system engineering models. The approach is demonstrated on the design of a hydraulic subsystem. Another paper, by Herold, presents an approach for checking architectural compliance of different kinds of artefacts created in the development of component-based systems. For that purpose, the authors use first order logic in their approach. A case study on Checking Architectural Layers for the purpose of quality assurance is presented. Yet another work in this topic by Astalos et. al. outlines a possible approach for verifying automatically declarative descriptions of Graph Rewriting-based Model Transformations. Finally, a paper by Straeten, presents a strategy for specifying semantics of a DSM through properties expressed already in the used DSL.

Multi-Formalism Composition/Integration - Braatz and Brandt discuss a possible technique for integrating heterogenous DSMLs by means of rule-based transformations. Examples of a visual DSML for IT and a DSML for firewall configurations are presented.

Model Evolution - Motivated by the problem of both Model and Metamodel evolution and the need of migrating instance models Meyers, Wimmer, Cichetti and Sprinkle discuss a new technique to guide the user in solving migration issues in a step-wise manner by means of in-place transformations.

Practical Case Studies - The paper by Zellag and Vangheluwe presents a DSL for the purpose of modelling and simulation of multitier systems. By using graph transformations the instance models in the referred DSL are translated into Queuing Petri Nets(QPNs) models which can be analysed and simulated by the SimQPN tool simulator.

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