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Special Issue with Selected Papers from ICGT 2004

Since its origins in the late 1960's, the field of graph transformations has been systematically developed and applied in the many areas where static and dynamic modeling by means of graphical structures play an important role. Following a successful First International Conference on Graph Transformation in Barcelona (ES), the Second International Conference on Graph Transformation (ICGT 2004) was held in Rome (IT) in September 2004. The ICGT series of conferences, to be held every 2 years, follows a series of international workshops that started in 1978 and were organized at four-year intervals. The scope of the conference encompasses graphical structures of various kinds, like graphs, trees, diagrams, networks, and visual sentences, as an intuitive and expressive way to describe complex systems, whose evolution is described by transformations of such graphical structures.

This special issue of Fundamenta Informaticae contains six papers that were submitted by invitation, and are based on the authors' contributions to ICGT 2004. These papers are substantial extensions of the conference papers and were reviewed through the normal review process for this journal.

The first two papers are strictly related. In the first one, Adhesive High-Level Replacement Systems: A New Categorical Framework for Graph Transformation, Hartmut Ehrig, Annegret Habel, Julia Padberg and Ulrike Prange combine the new concept of adhesive categories with the older (early 1990s') one of high-level replacement systems to obtain a framework that satisfies the properties of HLR categories starting from fewer and simpler assumptions. In the second one, Fundamental Theory for Typed Attributed Graphs and Graph Transformations based on Adhesive HLR Categories, Hartmut Ehrig, Karsten Ehrig, Ulrike Prange and Gabriele Taentzer provide a new formalization of typed attributed graphs to show that the category of such graphs and appropriate morphisms is an adhesive HLR category, from which fundamental results such as the Local Church-Rosser, Parallelism, Concurrency Theorems and the Critical Pair Lemma can be derived more easily.

The third paper, Stochastic Graph Transformation Systems, by Reiko Heckel, Georgios Lajios and Sebastian Menge, introduces an extension of attributed typed graph transformation systems where rules are associated with application rates, drawn from exponential distributions, to model their delayed applications. The Stochastic Graph Transformations Systems so defined naturally induce Continuous Time Markov Chains and Continuous Stochastic Logic to analyze the system's properties.

In the fourth paper, Local Computations in Graphs: the Case of Cellular Edge Local Computations, Jérémie Chalopin, Yves Métivier and Wieslaw Zielonka investigate a very elementary local graph computation model, one where the state transition (relabeling) of a network vertex depends only on its own

state and the state of one of its neighbors. The main result is a characterization of the classes of graphs that admit a naming algorithm and an election algorithm in such model.

The fifth paper, by Andrzej Ehrenfeucht, Jurriaan Hage, Tero Harju and Grzegorz Rozenberg, contains a study of The Embedding Problem for Switching Classes of Graphs and in particular the complexity of finding local transformations to provide the answer to a graph query (e.g., a deadlocked subnetwork). Besides some impossibility results, they provide an algorithm whose polynomial complexity depends on the cycle rank, not on the size, of the query graph.

In the sixth and final paper, Theory of Constraints and Application Conditions: from Graphs to High-Level Structure, Hartmut Ehrig, Karsten Ehrig, Annegret Habel and Karl-Heinz Pennemann revisit some results on graphs constraints and present a unified approach to constraints and application conditions suitable for high-level replacement systems in the context of adhesive HLR categories. The framework allows the transformation of constraints into right application conditions of rules, and the transformation from right to left application conditions.

While the scope of the conference was much broader than the scope of this issue, the six papers give a good insight into some of the methods used in the foundations of graph transformations. A special issue of Software and System Modeling is under preparation with a selection of papers from ICGT 2004 that address more practical aspects of graph transformations.

Many thanks go to the Program Committee of the ICGT 2004, for their work in the difficult task of choosing the papers to be presented, work that forms the basis for the selections of the authors to be invited to submit an extended version. In addition, the reviewing process benefited from the knowledge and effort of a number of experts: Paolo Baldan, Andrea Corradini, Bruno Courcelle, Reiko Heckel, Barbara Koenig, Manuel Koch, Hans-Jörg Kreowski, Steve Lack, John Pfaltz, Detlef Plump, Ulrike Prange, and Gabriel Valiente. Thanks to all of them for their help in refereeing the papers for this special issue in a timely manner.

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