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Preface

The second International Symposium on Formal Methods for Components and Objects (FMCO) was held in Leiden, The Netherlands, from November 4 to 7, 2003. The program consisted of invited presentations given by leading experts in the fields of Theoretical Computer Science and Software Engineering.

After the symposium, the speakers were invited to contribute to this special issue that discusses different aspects of models and verification techniques for component-based and object-oriented systems.

The organization of FMCO has been carried out in the context of the NWO/DFG bilateral project Mobi-J and of the European IST project Omega (2001-33522). In particular, we acknowledge the NWO funding of Mobi-J, without which this symposium could not have been organized. We appreciate the cooperation with Willem-Paul de Roever and Susanne Graf in the organization of the FMCO symposium.

This special issue opens with two articles describing different algebraic approaches to formal models of the behavior of object oriented systems. J. Bergstra and I. Bethke introduce an algebraic model for a client-server interaction mechanism underlying most component based and object oriented systems. Their main contribution is a definition of a reactive composition operator that models this mechanism, and the proof of its associativity.

R. Diaconescu presents a model of objects based on hidden algebras, a formal specification and verification paradigm for system development. He formally defines object composition operators with and without synchronization. For the composition operator with synchronization he proves the existence of a final semantics. The composition operator without synchronization is proved to be commutative and associative.

J.F. Groote and T. Willemse focus on a tool for verification of dynamic properties of transition systems, a most widely used operational model for the semantics of object-oriented and component-based systems. In particular they consider techniques for solving boolean equation systems with data, and provide examples of the use of these techniques in the verification of modal μ-calculus formulas on concrete transition systems.

Y. Gurevich, B. Rossman, and W. Schulte explain the design rationale and the semantics of a novel executable object-oriented specification language, the Abstract State Machine Language. This language provides high-level mathematical data-structures, and is built around the notion of synchronous updates and finite choice. Furthermore, it is fully integrated into the component framework of .NET.

C. Pieriek and F. de Boer describe a proof outline logic that covers most typical class-based object-oriented language constructs in the presence of inheritance and subtyping.

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Late binding is described by a novel variant of Hoare's rule of adaptation that captures the dynamic allocation of objects.

J. Rutten presents a coinductive stream calculus that serves, in general, as a semantic basis for dynamic component connectors. In this paper, he considers an application of the calculus to signal flow graphs. The formal treatment of flow graphs deals with two fundamental phenomena in the theory of computation: memory (in the form of register or delay elements) and infinite behavior (in the form of feedback).

In his article R. Stärk illustrates a high-level Abstract State Machine model of C♯ threads and the .NET memory model. The sequential model interleaves the computation steps of the currently running threads. The parallel model addresses the problem of true concurrency. Both models provide a sound basis for the development of multi-threaded applications in C♯.

This special issue concludes with an article by H. Wehrheim. She discusses which properties of a formally verified component are preserved when the component is changed due to an adaption to a new use.

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