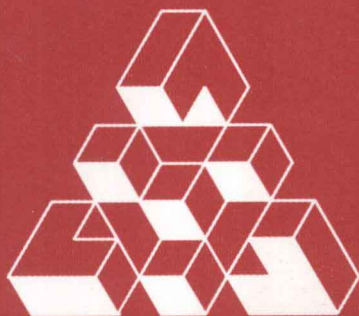


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Paweł Urzyczyn (Eds.)

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Mathematical Foundations of Computer Science 2006

31st International Symposium, MFCS 2006
Stará Lesná, Slovakia, August/September 2006
Proceedings

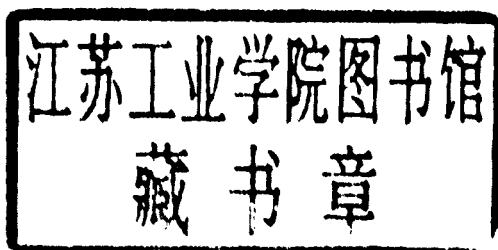


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31st International Symposium, MFCS 2006
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Preface

The series of Mathematical Foundations of Computer Science symposia has a well-established tradition dating back to 1972. Since the first meeting held in the Polish town of Jabłonna, the conference has gradually gained international recognition as an event bringing together researchers in all branches of theoretical computer science, promoting international cooperation, and encouraging high-quality research.

The present volume is a collection of papers presented at the 31st MFCS held in Stará Lesná, Slovakia, from August 28 to September 1, 2006. The scientific program of the 31st MFCS consisted of 62 contributed papers selected from the record high number of 174 submissions representing various areas of theoretical computer science and its mathematical foundations, complemented by 7 invited talks given by prominent researchers in the area. The symposium took place in the Academia Hotel resort situated at the foot of the Lomnický peak in the eastern part of the Vysoké Tatry Mountains in Slovakia, on the border of the Tatra National Park, close to the picturesque towns of Tatranská Lomnica and Starý Smokovec.

During its rich history, MFCS has been held in a number of places in Poland, Slovakia, and the Czech Republic, always striving to present the highest quality research in areas ranging from algorithms and data structures, to complexity, automata, semantics, logic, formal specifications, models of computation, concurrency theory, computational geometry, parallel and distributed computing, networks, bioinformatics, quantum computing, cryptography, knowledge-based systems, artificial intelligence, to mention just a few. The 2006 meeting added a new page to this history, an addition that was made possible thanks to the effort of many people.

As editors of these proceedings, we are very much indebted to all contributors to the scientific program. Our thanks are due to all authors who submitted their papers, thus showing their interest in MFCS, to all invited speakers who were willing to attend the event and share their insights, to all members of the Program Committee who did excellent work in the very difficult decision process, and to all external referees without whose help it would not be possible to evaluate so many contributions in so little time. We also gratefully acknowledge the use of the EasyChair conference system. Our thanks extend to the organizing team lead by Vanda Hambáľková and Dana Pardubská, without whom this meeting could not take place. Finally, we would like to thank Springer for their professional co-operation in printing this volume, and to all participants for attending MFCS 2006.

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A Core Calculus for Scala Type Checking

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Abstract. We present a minimal core calculus that captures interesting constructs of the Scala programming language: nested classes, abstract types, mixin composition, and path dependent types. We show that the problems of type assignment and subtyping in this calculus are decidable.

1 Introduction

The programming language Scala proposes a new model for component systems [28]. Components in this model are classes, which can be combined using nesting and mixin composition. Classes can contain abstract types which may be instantiated in subclasses. The Scala component model thus provides a single framework for the construction of objects and modules. Modules are identified with objects, functors with classes, and signatures with traits.

The advantage of this approach is that a single fairly small set of language constructs is sufficient for core programming as well as the definition of components and their composition. Furthermore, the identification of modules and objects provides new ways to formulate standard programming tasks such as the expression problem [14,33,27] and family polymorphism [12,28].

Scala's approach to component modeling is based on three programming language constructs: modular mixin composition, abstract type members, and explicit self-types. All three have been studied in the νObj calculus [25]. A key concept of the νObj calculus, path-dependent types, is also present in Scala. However, some other constructions of νObj do not correspond to Scala language constructs. In particular, νObj has first-class classes which can be passed around as values, but Scala has not.

First-class classes were essential in establishing an encoding of $F_{<}$ in νObj , which led to a proof of undecidability of νObj by reduction to the same property in $F_{<}$ [29]. However, since Scala lacks first-class classes, the undecidability result for the calculus does not imply that type checking for the programming language is undecidable.

In this paper, we study the problem of decidability of Scala type checking. We construct (algorithmic) Featherweight Scala, abbreviated FS_{alg} , a minimal core calculus of classes that captures an essential set of features of Scala's type system.