
Preface

This book gives a comprehensive account of Maude, a language and system based on rewriting logic. Many examples are used throughout the book to illustrate the main ideas and features of Maude, and its many possible uses. Maude modules are rewrite theories. Computation with such modules is efficient deduction by rewriting. Because of its logical basis and its initial model semantics, a Maude module defines a precise mathematical model. This means that Maude and its formal tool environment can be used in three, mutually reinforcing ways:

- as a declarative programming language;
- as an executable formal specification language; and
- as a formal verification system.

Maude’s rewriting logic is simple, yet very expressive. This gives Maude good representational capabilities as a *semantic framework* to formally represent a wide range of systems, including models of concurrency, distributed algorithms, network protocols, semantics of programming languages, and models of cell biology. Rewriting logic is also an expressive *universal logic*, making Maude a flexible *logical framework* in which many different logics and inference systems can be represented and mechanized. This makes Maude a useful *metatool* to build many other tools, including those in its own formal tool environment. Thanks to the logic’s simplicity and the use of advanced semi-compilation techniques, Maude has a high-performance implementation, making it competitive with other declarative programming languages.

The introduction (Chapter 1) gives a high-level overview of Maude’s main concepts and underlying philosophy, and of its various applications. Since this book gives a very complete account of Maude in its various aspects, Section 1.7 gives specific suggestions on different reading “paths” within the book, that can be chosen depending on the degree of prior familiarity with the main ideas and the various uses intended, for example, as a programming language or as a formal specification and verification tool.

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Languages are living organisms. The lifeblood provided by experienced users is key to their growth and their improvement. We have benefited much from colleagues who have used different alpha versions of Maude; we cannot mention them all, but Christiano Braga, Feng Chen, Grit Denker, Azadeh Farzan, Joe Hendrix, Merrill Knapp, Nirman Kumar, Peter Ölveczky, Miguel Palomino, Adrián Riesco, Dilia Rodríguez, Grigore Roşu, Ralf Sasse, Koushik Sen, Ambarish Sridharanarayanan, Mark-Oliver Stehr, Prasanna Thati, and Alberto Verdejo deserve special thanks for their creative uses of Maude and their suggestions for improving the language.

This book project has gone through many drafts as new features were added to Maude and new chapters and examples were added to the book. We have benefited much from valuable comments and constructive criticism provided by several colleagues at different stages, including in some cases detailed comments to the latest drafts when the book was nearing its completion. For all these comments we cordially thank Christiano Braga, Peter Mosses, Peter Ölveczky, Miguel Palomino, Sylvan Pinsky, Isabel Pita, Adrián Riesco, Dilia Rodríguez, Manuel Roldán, Mark-Oliver Stehr, Antonio Vallecillo, and Alberto Verdejo.

We are grateful to José Quesada, who developed MSCP, the Maude parser. MSCP is implemented using SCP [271] as the formal kernel, and provides a basis for flexible syntax definition, and an efficient treatment of what might be called *syntactic reflection*.

Maude's historical precursor is the OBJ3 language [146]. The OBJ3 experience has greatly influenced the Maude design and philosophy, and we are grateful to all our former OBJ colleagues for this. Joseph Goguen, to whose

memory this book is dedicated, should be mentioned in particular, because of his enormous influence in all aspects of OBJ; and Tim Winkler for having implemented a state-of-the-art OBJ3 system with such great skill.

Two other rewriting logic languages, ELAN [22] and CafeOBJ [138], have provided a rich stimulus to the design of Maude. Although our language design solutions have often been different, we have all been wrestling with a similar problem: how to best obtain efficient language implementations of rewriting-based languages. We have benefited much from the ELAN and CafeOBJ experience, and from many discussions with their main designers and implementers: Claude and Hélène Kirchner, Marian Vittek, Pierre-Etienne Moreau, Kokichi Futatsugi, Răzvan Diaconescu, Ataru Nakagawa, Toshimi Sawada, and Makoto Ishisone.

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All About Maude - A High-Performance Logical
Framework

How to Specify, Program, and Verify Systems in
Rewriting Logic

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