

# Rewriting Logic Modulo Rewriting

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## 1 Context

This internship is at the crossroad of logic and rewriting techniques. It also appeals to compilation and optimization/performance skills.

Dedukti [BCH12] is a type-checker for the lambda-Pi calculus modulo, a type system for the  $\lambda$ -calculus characterized by two features:

- dependent types,
- a conversion rule generated by  $\beta$ -reduction and rewriting modulo a given set of rewrite rules.

Maude [CDE<sup>+</sup>03] is a general framework implementing Rewriting Logic [MOM02], that enables reasoning modulo rewrite rules *and* on rewrite rules.

Preliminary experiments [Sai13] have shown that the reduction algorithm (an adaptation of the abstract machine of Matita [ARSCT09] to take into account rewrite rules) has comparable results to Maude when it comes to simple rewriting.

## 2 Subject

Several questions arise from those experiments: theoretically speaking, can we express one framework in the other, in either direction ? Some hints suggest that it should be possible (Maude pretends having a kind of dependent types). Practically speaking, can we (re-)write Dedukti in Maude ? From the other end: can we use Dedukti as a rewriting engine for Maude ? Can we improve the rewriting mechanisms of Dedukti so that it becomes even more competitive wrt Maude ? For this, one of the potential direction is the use of Meta-OCaml.

The subject we propose is very broad and, depending on the preferences of the intern, one or the other questions will be tackled. Answering at least one of them will be a very significant advance.

## 3 Prerequisites

A course on the foundations of computer science such as logic, type theory or rewriting.

## 4 Output and Experience

The internship will result in a deep understanding on the connections between the  $\lambda\Pi$ -calculus modulo and Rewriting Logic and, depending on the orientation it will take: improvements of the type-checking and of the rewriting algorithm, better performances or even a prototype compiler.

## 5 Environment

The intern will be hosted by the Deducteam project-team at Inria Paris and/or the CRI at MINES ParisTech.

## References

- [ARSCT09] A. Asperti, W. Ricciotti, C. Sacerdoti Coen, and E. Tassi. A compact kernel for the calculus of inductive constructions. *Sadhana*, 34(1):71–144, 2009.
- [BCH12] Mathieu Boespflug, Quentin Carbonneaux, and Olivier Hermant. The  $\lambda\Pi$ -calculus modulo as a universal proof language. volume 878, pages 28–43. CEUR-WS.org, 2012.
- [CDE<sup>+</sup>03] Manuel Clavel, Francisco Durán, Steven Eker, Patrick Lincoln, Narciso Martí-Oliet, José Meseguer, and Carolyn Talcott. The maude 2.0 system. In Robert Nieuwenhuis, editor, *Rewriting Techniques and Applications (RTA 2003)*, number 2706 in Lecture Notes in Computer Science, pages 76–87. Springer-Verlag, June 2003.
- [MOM02] Narciso Martí-Oliet and José Meseguer. Rewriting logic: roadmap and bibliography. *Theor. Comput. Sci.*, 285(2):121–154, 2002.
- [Sai13] Ronan Saillard. Towards explicit rewrite rules in the lambda-pi calculus modulo. In *IWIL*, 2013.