

**RESEARCH TOPIC FOR THE PARISTECH/CSC PHD PROGRAM**  
*(one page maximum)*

**Field:** Information and Communication Sciences and Technologies

**Subfield:** Computer Science

**Title:** Scaling Up Polarized Deduction Modulo Theory

**ParisTech School:** MINES ParisTech | PSL

**Advisor(s) Name:** Olivier Hermant

**Advisor(s) Email:** olivier.hermant@mines-paristech.fr

**Research group/Lab:** Centre de recherche en informatique

**Lab location:** Fontainebleau, France

**(Lab/Advisor website):** <http://www.cri.mines-paristech.fr>

**Short description of possible research topics for a PhD:**

Formal methods aims at ensuring *provably bug-free* software. An industrial benchmark of ten of thousands of problems has given us the opportunity to jointly develop automated theorem provers and proof checkers.

The research subject aims at extending those tools and their logical foundations in the direction of polarized rewriting, where conditional computation steps are embedded into reasoning step, a feature that gave excellent preliminary results on the benchmark. Our tools are also critically dependent on the strategy adopted. As this strategy is dependent on the shape of the problem, another part of the research subject is to learn automatically how to trigger the best heuristics.

**Required background of the student:** an M.Sc.-level specialization in any field of computer science or in the foundations of mathematics. More specialized courses, among which machine learning, compilers, logics, theoretical computer science, or functional programming are a plus.

**Representative publications of the group:**

1. G. Burel, G. Bury, R. Cauderlier, D. Delahaye, P. Halmagrand, and O. Hermant. *Automated deduction: When deduction modulo theory meets the practice*. Journal of Automated Reasoning 64(6), pp. 1001–1060, 2020.
2. M. Boespflug, Q. Carbonneaux, and O. Hermant. *The  $\lambda\Pi$ -calculus modulo as a universal proof language*. In Second Workshop on Proof Exchange for Theorem Proving (PxTP), volume 878, pp. 28–43, CEUR-WS.org, 2012.
3. G. Dowek. *Polarized deduction modulo*. In IFIP Theoretical Computer Science, 2010.
4. The BWare Project, 2012. <http://bware.lri.fr/>