Proposition de Stage de Recherche:
Terminaison de programmes : algorithmique et complexité

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Location At the convenience of the candidate, the geographic place for this internship will work either in Grenoble or in Lille.

Keywords Static Analysis, Satisfiability Modulo Theory, Abstract Interpretation, Termination, Complexity.

Context Proving the termination of a flowchart program can be done by exhibiting a ranking function, i.e., a function from the program states to a well-founded set, which strictly decreases at each program step. In [1] we propose a general algorithm for the computation of linear ranking functions, which is adaptation of the Linear-Programming based scheduling method of [2]. However, as the underlying LP instances consider the control flow graph globally, there is a challenging scaling issue.

We are currently working on a reformulation of the previous algorithm that allows to incrementally solve the LP instances, by using SMT (satisfiability modulo theory)-queries for selecting "pertinent" constraints to be added to the current system-to-solve.

We think that combining this new technique with control-graph succint representation [3] will improve the performance of the method.

Internship subject The candidate, according to his skills and preferences, will be expected to :

- Study our current proposition that tries to enhanced the scalability of termination kernels, and propose extensions and improvements ;
- Implement the algorithm and evaluate its performance ;
- Study the theorical complexity of the underlying problems.

Desired knowledge / skills (but not limited) Background in formal/mathematics approaches (in particular, static analysis, complexity theory and logics) are required.

Références

[1] Christophe Alias, Alain Darte, Paul Feautrier, and Laure Gonnord. Multi-dimensional Rankings, Program Termination, and Complexity Bounds of Flowchart Programs. In *Static Analysis Symposium*, Perpignan France, 2010.

[2] Alain Darte and Frédéric Vivien. Optimal fine and medium grain parallelism detection in polyhedral reduced dependence graphs. *International Journal of Parallel Programming*, 25(6) :447–496, December 1997.

[3] Julien Henry, David Monniaux, and Matthieu Moy. Succinct representations for abstract interpretation. In *Static analysis (SAS)*, volume 7460 of *Lecture Notes in Computer Science*, pages 283–299. Springer Verlag, 2012.

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