

# Internship proposal

## Design and implementation of the Parametrised Polyhedra Abstract Domain

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**Context** This internship takes place in the EMERAUDE team of LIFL (Lille, France). The topics of this team include compilation for parallel platforms.

**Internship Subject** Recently ([3]), we have combined methods and tools from automatic parallelisation domain and static analysis domain. We believe that this connection is worth to be studied.

This internship will investigate the use of parametrised polyhedra in static analysis. The classic Linear Relation analysis ([4, 5]), which is an abstract interpretation based on (rational) polyhedra, use parameters as if they were variables, which causes a strong loss of precision.

The candidate will design a new abstract domain, following the framework of [6], to deal with parametrised polyhedra ([1, 2]) instead of classical polyhedra. He will implement this abstract domain in the `Aspic`<sup>1</sup> Tool. He will apply his results on termination problems.

**Desired knowledge / skills** Serious formal bases (in particular, automata and compilation) are required. The candidate will implement the abstract domain in his favorite programming language (preferably in OCaml or C++), and will use the `piplib` library<sup>2</sup>

**Keywords** Static Analysis, Flowcharts Programs, Polyhedra, Linear Relation Analysis, Parameters.

### Références

- [1] Paul Feautrier. Some efficient solutions to the affine scheduling problem, part I, one-dimensional time. *International Journal of Parallel Programming*, 21(5) :313–348, October 1992.
- [2] Paul Feautrier. Some efficient solutions to the affine scheduling problem, part II, multi-dimensional time. *International Journal of Parallel Programming*, 21(6) :389–420, December 1992.
- [3] 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.
- [4] P. Cousot and N. Halbwachs. Automatic discovery of linear restraints among variables of a program. In *5th ACM Symposium on Principles of Programming Languages (POPL'78)*, pages 84–96, Tucson, January 1978.
- [5] N. Halbwachs. Détermination automatique de relations linéaires vérifiées par les variables d'un programme. PhD thesis, Université de Grenoble, March 1979.
- [6] P. Cousot and R. Cousot. Abstract interpretation : A unified lattice model for static analysis of programs by construction or approximation of fixpoints. In *4th ACM Symposium on Principles of Programming Languages (POPL'77)*, pages 238–252, Los Angeles, January 1977.

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1. <http://laure.gonnord.org/pro/aspic/>

2. <http://www.piplib.org/>