

# Three Research positions (engineer or postdoc) in the ANR HPAC project: Grenoble, Lyon and Paris, France

## Title: High-performance Algebraic Computing

Keywords: parallel computing, computer algebra, linear algebra, C/C++ programming

### INFORMATION

Locations:

**Grenoble:** LJK-CASYS (<http://www-ljk.imag.fr>) and LIG-MOAIIS (<http://moais.imag.fr>)

**Lyon:** LIP-AriC (<http://www.ens-lyon.fr/LIP/AriC/>)

**Paris:** LIP6-PolSys (<http://www-polysys.lip6.fr/>)

Type of positions: Postdoc or engineer

Duration: 3 positions of 12 months each

Starting date: from June 2014 to January 2015

Salary: approx. 1 950€/ month for engineer and 2 100 €/month for postdocs (monthly net salary health care included)

Qualification: Engineer or Doctorate degree in computer science, mathematics or applied mathematics

Contacts: [Jean-Guillaume.Dumas@imag.fr](mailto:Jean-Guillaume.Dumas@imag.fr), [Jean-Charles.Faugere@inria.fr](mailto:Jean-Charles.Faugere@inria.fr), [Clement.Pernet@imag.fr](mailto:Clement.Pernet@imag.fr), [Gilles.Villard@ens-lyon.fr](mailto:Gilles.Villard@ens-lyon.fr)

Application: please send a C.V. by e-mail to ([Jean-Guillaume.Dumas@imag.fr](mailto:Jean-Guillaume.Dumas@imag.fr) and [Clement.Pernet@imag.fr](mailto:Clement.Pernet@imag.fr)) together with the contact information (e-mail addresses) of one or two references who could recommend your application. Please also mention the type of position (postdoc or engineer) that you apply for and the location where you want to apply to (this is just indicative and not a formal commitment).

### CONTEXT AND WORKPLAN

**General context.** These research positions are offered by the project HPAC<sup>1</sup> (High Performance Algebraic Computing) funded for four years by the french research agency ANR under grant ANR-11-BS02-013. The ambition of the project HPAC is to provide international reference high-performance libraries for exact linear algebra and algebraic systems on multi-processor architectures and to influence parallel programming approaches for algebraic computing. It focuses on the design of new parallel algorithms and building blocks dedicated to exact linear algebra routines. These blocks will then be used for the parallelization of the sequential code of the LinBox<sup>2</sup> and FGb<sup>3</sup> libraries, state of the art for exact linear algebra and polynomial systems solving, and used in many computer algebra systems. The project combines several areas of expertise: parallel run-time and language, exact, symbolic and symbolic/numeric algorithmic, and software engineering.

**Profile of the positions.** We are seeking for candidates with solid expertise in software library design and developments (e.g. C, C++, OpenMP, Autotools, versioning, ...) with preferably good background on mathematical software and computer algebra algorithmic. The main outcome of the work will depend on the type of the position (postdoc or engineer) and include code development in open-source C/C++ libraries such as LinBox, LELA (used by FGb), Kaapi and research publications in international journals or conferences.

<sup>1</sup><http://hpac.gforge.inria.fr>

<sup>2</sup><http://www.linalg.org>

<sup>3</sup><http://www-polysys.lip6.fr/~jcf/Software/FGb>

Each location is seeking for candidates matching with the following keywords:

- Lyon:** **Contact:** [Gilles.Villard@ens-lyon.fr](mailto:Gilles.Villard@ens-lyon.fr)  
High performance/parallel computer algebra, symbolic and mixed symbolic-numeric linear algebra, validated computation, high performance Euclidean lattice computation, lattice basis reduction [4].
- Grenoble:** **Contact:** [Jean-Guillaume.Dumas@imag.fr](mailto:Jean-Guillaume.Dumas@imag.fr)  
Library design and development, LinBox, Sage, XKaapi, parallel exact linear algebra, work-stealing and data-flow tasks [3, 1].
- Paris:** **Contact:** [Jean-Charles.Faugere@inria.fr](mailto:Jean-Charles.Faugere@inria.fr)  
Polynomial system solving, Gröbner basis computations [2], parallel exact linear algebra, algebraic cryptanalysis, distributed computing.

Feel free to exchange with the contact person of each place for further information.

## References

- [1] Jean-Guillaume Dumas, Thierry Gautier, Clément Pernet, and B. Saunders. [LinBox Founding Scope Allocation, Parallel Building Blocks, and Separate Compilation](#). In Komei Fukuda, Joris Hoeven, Michael Joswig, and Nobuki Takayama, editors, *Mathematical Software – ICMS 2010*, volume 6327 of *Lecture Notes in Computer Science*, pages 77–83. Springer Berlin / Heidelberg, 2010.
- [2] Jean-Charles Faugère. [A new efficient algorithm for computing Gröbner bases without reduction to zero \(F5\)](#). In *Proceedings of the 2002 international symposium on Symbolic and algebraic computation*, ISSAC '02, pages 75–83, New York, NY, USA, 2002. ACM.
- [3] Thierry Gautier, Xavier Besseron, and Laurent Pigeon. [KA-API: A Thread Scheduling Runtime System for Data Flow Computations on Cluster of Multi-Processors](#). In *Parallel Symbolic Computation'07 (PASCO'07)*, number 15–23, London, Ontario, Canada, 2007. ACM.
- [4] Andrew Novocin, Damien Stehlé, and Gilles Villard. An LLL-reduction algorithm with quasi-linear time complexity: Extended abstract. In *Proceedings of the 43rd Annual ACM Symposium on Theory of Computing*, STOC '11, pages 403–412, New York, NY, USA, 2011. ACM.