# Dpt : CalSci

*The Department of Scientific Computing covers both symbolic and numerical computations. This department gathers two teams. The scientific activity is organized around several specific actions.*

### *SYNUS action (SYmbolic and NUmerical Solving)*

**Keywords :** guaranteed results, symbolic/numerical algorithms

The SYNUS action aims at combining and developing symbolic and numerical algorithms for scientific computing. We want to improve the efficiency of symbolic algorithms by performing numerical computations when finite precision is appropriate.

### *GEOALG action (Algebraic Computational Geometry)*

**Keywords :** Algebraic geometry, Polynomial Systems, topology

This action aims at developing algorithms based on polynomial system solving for dealing efficiently with 3D algebraic objects in algorithm geometry (curves, surfaces) and the study of their topology.

### *Images and dynamics action*

**Keywords :** dynamical models, missing data, multiobject tracking, motion estimation

This action focuses on 2D and 3D sequence processing. For this purpose, models of the dynamics are used to describe the evolution of image structures, notably in the presence of missing data. Our methodologies rely on particle filters and variational data assimilation frameworks.

### *ADOR action (Artithmétique Des ORdinateurs)*

**Keywords :** floating point, fixed point, representation of numbers, numerical validation

This action deals with the aspects of scientific computing relied to elementary arithmetic operations on every materials (microprocessors, SoC, embedded systems). A special focus is dedicated on numerical validation (CADNA library, SOFIA toolbox) and on the representations of numbers on computers with the associated algorithms.

## PEQUAN team

(PErformance et QUalité des Algorithmes Numériques)

**The domain of the PEQUAN team deals with computer arithmetic and scientific calculus.**

**The team has developed the CADNA library and the SOFA toolbox based on a probabilistic approach of round-off error propagation.**
**The skill of the team covers:**

- **development of numerical algorithms using floating point or fixed point arithmetic and their numerical validation**
- **implementation of parallel numerical applications,**
- **systems of numeration and the associated algorithms in relationship with cryptology or signal processing,**
- **problems related to the modeling of 2D and 3D dynamics in video sequences.**

### *CRYPTALG action (Algebraic Cryptanalysis)*

**Keywords :** security, Cryptanalysis, Gröbner Bases, finit fields

The goal of this action is to evaluate the security of a cryptosystem by reducing its study to the solving of a polynomial system with coefficients in a finite field. These attacks require the use of the most efficient Gröbner bases algorithms and a huge amount of computational resources (CPU and RAM as well).

### *PANAM action (PArallel Numerical AlgorithMs).*

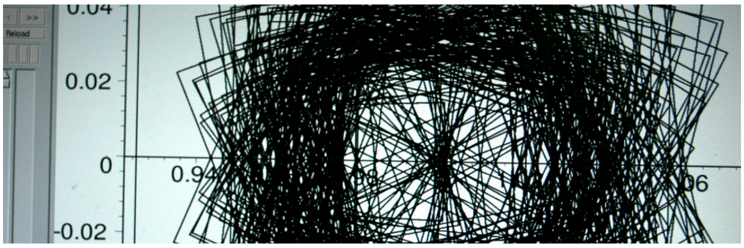
**Keywords :** efficient numerical algorithms, new architectures, grid computing, numerical kernels

The goal of this action is the development of optimized numerical algorithms or kernels to reach a high level of performance (speed and/or numerical quality) on parallel computers, grids or heterogeneous systems.

### *EXACTA action*

**Keywords :** polynomial functions, noisy systems, exact computations

The goal of this action is to develop algorithms yielding an exact resolution for global optimization problems of polynomial functions under polynomial constraints. Noisy systems (when equations contain errors) are also considered. These works are led with the Royal Holloway University of London, Chinese Academy of Sciences, Beihang University and Peking University.




## SALSA team

(Solving ALgebraic Systems and Applications)

**SALSA is a joint team between INRIA and University Pierre and Marie Curie in the area of solving polynomial systems using exact methods. Our goal is to develop efficient algorithms for computing the complex solutions and/or the real ones of polynomial systems in a finite field. Our group has developed several fundamental algorithms, in particular algorithms for computing Gröbner bases and algorithms based on the so-called critical point method. Complexity issues are also investigated. The practical efficiency of our algorithms relies on highly efficient linear algebra libraries where the group is strongly involved.**