



INSTITUT NATIONAL DE RECHERCHE EN INFORMATIQUE ET EN AUTOMATIQUE

*Project-Team Scilab*

*Equipe opérationnelle du consortium  
Scilab*

*Rocquencourt*

THEME NUM

*Activity*  
*R* *eport*

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# 1. Team

## **Head of project team**

Claude Gomez [DR, Inria]

## **Administrative assistant**

Martine Verneuille [AI, Inria]

## **Staff member**

François Delebecque [DR, Inria, part time]

Serge Steer [DR, Inria, part time]

## **Visiting technical staff**

Didier Halgand [since mid-December 2004]

Hugues Perdereau

## **Technical staff**

Farid Belahcene [since December 2004]

Allan Cornet

Vincent Couvert [until November 2004]

Olivier Huynh [until September 2004]

Fabrice Leray [since February 2004]

Pierre Maréchal [since September 2004]

## **Research scientist**

Robert Ehrlich

## **Student intern**

Céline Fontaine

Pierrick Mode

# 2. Overall Objectives

Scilab is a scientific software package providing a powerful open computing environment for engineering and scientific applications. Developed since 1990 by INRIA and ENPC, it is now maintained and developed by Scilab Consortium which was launched in May 2003.

Scilab project is not a “research project” but a “development project” at INRIA-Rocquencourt. It is the operational team of Scilab Consortium.

Scilab is distributed freely with the sources via the Internet since 1994, Scilab is currently being used in educational and industrial environments around the world.

Scilab includes hundreds of mathematical functions with the possibility to add interactively programs from various languages (FORTRAN, C, C++, JAVA...). It has sophisticated data structures (including lists, polynomials, rational functions, linear systems...), an interpreter and a high level programming language.

Scilab has been conceived to be an open system where the user can define new data types and operations on these data types by overloading operators.

A number of toolboxes are available with the system:

- 2-D and 3-D graphics, animation.
- Linear algebra, sparse matrices.
- Polynomials and rational functions.
- Mathematical functions.
- Simulation: ODE solver (ODEPACK) and DAE solver (DASSL).
- Scicos: hybrid dynamic systems (comparable to Simulink).

- Classic and robust control, LMI optimization.
- Differentiable and non-differentiable optimization.
- Signal processing.
- Metanet: graphs and networks.
- Parallel Scilab using PVM.
- Statistics.
- Interface with Computer Algebra (Maple, MuPAD).
- Interface with TCL/TK.
- And a great number of contributions for various domains.

Scilab works on most UNIX systems including GNU/Linux and on Windows 9X/NT/2000/XP. It comes with source code, on-line help and English user manuals. Binary versions are available.

**Web site**

Newsgroup: `comp.soft-sys.math.scilab`

Contact: `Scilab@inria.fr`

## 3. Scientific Foundations

### 3.1. Scilab Consortium

Scilab Consortium has been created in May 2003. Today there are 14 members: APPEDGE, AXS INGENIERIE, CEA, CNES, CRIL TECHNOLOGY, DASSAULT-AVIATION, EDF, ENPC, ESTEREL TECHNOLOGIES, INRIA, PSA PEUGEOT CITROËN, RENAULT, THALES and TNI.

There are also five contributor members who are natural persons who made important contributions to Scilab and who are accepted by the steering committee of consortium.

The purpose of Scilab Consortium is:

- To organize cooperation and exchange within the community of developers in order to make Scilab a platform which integrates the latest scientific advances in the field of numerical computation.
- To organize cooperation and exchange within the community of users in order to make Scilab a product that meets specifications required for use in industrial, educational and research environments.
- To obtain the resources necessary to maintain a team committed to editing new versions of the software which meets specified standards, encourage the community of developers and ensure first level support for users.

The Consortium is chaired by Doctor Maurice Robin.

The main parts of the Consortium are:

- The *Conference of Participants* elects the persons taking part to the Steering Committee and to the Scientific Board and decides any other matter proposed for the agenda by the Steering Committee. The participants can take part to working groups. The purpose of working groups is to help and prepare the decisions of the steering committee. There are three working groups: on Scilab licence, on Scilab promotion and for the international development of Scilab.
- The *Steering Committee* is the decision-making body representing the Consortium's Conference of Participants.
- The *Scientific Board* analyses the scientific value of contributions and previews the scientific value of developments to be carried out.
- the *Operational Team* described below.

## 3.2. Operational Team

The Operational Team implements the decisions of the Consortium about Scilab development and promotion. It is the “Scilab development project” at INRIA-Rocquencourt.

The team is organized as follows:

- The Chief Technology Officer who manages the operational team: Claude Gomez.
- The Promotion and Marketing Manager who is responsible for promoting the software, recruiting new Members, conducting communications and promotional activities and communicating the users' needs: Didier Halgand who just arrived.
- The Quality Assurance Manager who monitors and enhances quality assurance processes used in development and maintenance of Scilab: Hugues Perdereau.
- The Contributor Network Development Manager who monitors and solicits contributions, coordinates and develops the Contributor community and serves as the point of contact for the various bodies for information regarding Accepted Contributions: François Delebecque.
- The Product Manager who is responsible for product policy for Scilab software: Claude Gomez.
- The Development Manager who coordinates the Development Team: Serge Steer.

The Development Team, tasked with developing or delegating the development of new functions or enhancement of existing features, evaluating new contributions in collaboration with the Scientific Board for purposes of their acceptance, and to compile and distribute subsequent versions of the Scilab software. It is compound by:

- Allan Cornet.
- Vincent Couvert replaced by Farid Belahcene.
- Olivier Huynh replaced by Pierre Maréchal.
- Fabrice Leray.

## 4. Software

### 4.1. New Scilab release

First of all, Scilab 3.0 was released on July 2004. This new Scilab release is a major Scilab release. The main improvements of this new release are:

- The Windows port has been completely rewritten: standard Windows look and feel (files association menus), integrated editor, improvement of the performances with optimized compilers.
- The new Object Oriented Graphics is now the standard graphics used to make 2-D and 3-D plotting: plots are made of entities with properties and handles. It is now possible to access and modify these properties using a graphics editor.
- Matlab to Scilab Conversion Tool: it allows to convert Matlab code to Scilab code. It is based upon a kernel which works on a Scilab tree of the code to be converted. So, it is possible to extend gradually the number of converted Matlab functions: a few hundred functions are currently converted. A Matlab/Scilab function dictionary has also been written.

## 4.2. Scilab Development

The Scilab development is based on a management plan and a quality policy. We describe below :

- The management plan.
- The quality assurance plan.
- The bug tracking policy.
- The qualification procedure and the qualification environment.

**The management plan** A management plan has been written and diffused to the Steering Committee of the Consortium. This document gives the general rules that the operational team sets up for the realization of the development of Scilab software within consortium framework.

- Operational organization and regular check (team organization, responsibilities, meetings, etc.)
- Road map proposal (calendar and dead-line).

**The quality assurance plan (draft version)** This document gives the general rules that the operational team sets up for the management, the development, the qualification, the diffusion and the maintenance of Scilab software.

- Quality plan (organization and follow-up).
- Cross procedures to the Scilab activity (documentation management and configuration management).
- Qualification procedure (process, referential, non-regression and implementation).
- Management procedure of the technical requests (bugs management, means, etc.).

**The bug tracking policy** The chosen policy is to have a complete tracability of all the Scilab bugs and requests. In order to respect the policy, an open source tool (Bugzilla) has been modified and installed to manage and track the Scilab bugs and the Scilab requests (see below the description of the bug tracking system).

**The qualification procedure and the qualification environment** Scilab team has defined and installed a qualification procedure and related environment to ensure the internal acceptance of the scilab software.

This procedure is based upon a reference scale of qualification. Each step of this scale is composed of critical elements and information elements:

- critical elements generally correspond to tests which must be successfully passed to achieve acceptance,
- information elements corresponds to others tests, documentation checking, etc.

This provides not only criteria for classical acceptance but also thorough information on the final state of the scilab product version to be described in “released notes” document as well as known by support team prior to external delivery.

The used methodology should be answer to the constraint of a software product:

- large diffusion
- heterogenous target machine
- regular delivery (major or minor releases)



### 4.3. Technical support

- Technical support daily activities.
  - Answering emails coming from Scilab users and forwarding the emails to the Scilab experts in cas of specialized problem.
  - Filtering and deleting spam emails by using procmail software.
  - Managing the bugzilla system and the database.
  - Administrating the CVS server, managing the users, and access.
- Automatic compilation chain

To test every day the compilation of Scilab sources provided by our CVS server, an automatic compilation chain has been installed. It starts every night on various platforms (Linux, Windows, Solaris and HP).

This compilation chain has three main tasks:

  - Compile Scilab CVS sources.
  - Produce a daily unstable version of scilab on differents platforms;
  - Launch various test batteries.

This process id very important for debugging Scilab when source code is modified. Moreover it allows the team to release such called “unstable versions” about every month: these version are not fully qualified but they allow the users to benefit from the last developments and bugs fixing.
- Scilab Website
  - **Scilab website** was completly rewritten and updated using PHP dynamic pages.
- Bugzilla: a bug tracking system for Scilab

In addition to the Scilab newsgroup, providing a wealthy Scilab software knowledge database, the Scilab development team proposes on Scilab website the Scilab bugs tracking system, a bugzilla-based system. It is a centralized web-database tracking system for Scilab bugs and Scilab requests. This tool allows to share and take advantage of the experiment of the Scilab community (developers and users). Now, each user, after creating an account, can:

  - create a new bug report or a new request,
  - give an attached file reproducing the defect and/or advising a workaround,
  - make a search in the bugs database or requests database,
  - find an existing patch for a registered bug.

#### + Scilab developers

CVS source code and the gestion of Bugzilla has been open to people called “Scilab Developers”: there can modify Scilab code directly, add functionalities and fix bugs. They work in accordance with Scilab team, under the management of the development manager. Decided Web pages have been made for them with all the information needed for coordinating the development.

There are presently 5 such Scilab developers which are not members of Scilab team.

## 4.4. Windows Version

The Windows Scilab 3.0 release has been completely rewritten and has now the following improvements:

- Transcription of all the Visual C++ Makefile's towards the Visual Studio .NET environment:
  - Improvement of the stability.
  - Dramatic improvement of the speed of Scilab.
  - Optimization for various processors (Atlas Library).
- Integration of the Scilab software to the Windows environment by modification of the GUI to have the Windows look and feel:
  - Files association with Scilab.
  - Beginning of rewriting of dialogues boxes and adding toolbar.
  - Management of the menus (French and English).
  - Command Window for interactive exploration and development.
- Integration of a free embedded compiler C in Scilab so that Scilab be autonomous to generate code C.
- DDE (Dynamic Data Exchange) client functions have been added to the Windows version. It allows communication with other Windows application supporting this communication (Word, Excel, ...)

## 4.5. New Object Oriented Graphics

Even if Scilab graphics is quite powerful, users complains in particular about the graphics functions syntax and the poor customization tools available. The conception of this graphic does not allow to make it evolve enough. A new entity oriented graphics has been built. To ensure backward compatibility the old graphic has been maintained.

In the new mode (enabled by default since version 3.0), each graphics window and the drawing it contains are represented by hierarchical entities. The hierarchy top level is the "Figure". Each Figure defines at least one child of type "Axes". Each Axes entity contains a set of leaf entities which are the basic graphics objects like Polylines, Rectangles, Arcs, Segs, ...It can also contain "Agregation" entities which are recursive sets of entities.

Graphics entities are associated to Scilab variables of type handle. The handle is a unique identifier which is associated to an instance of an entity. Using this handle, it is possible to control the properties of the entities using the "set" and "get" functions. The handles are also used to manipulate graphics objects, to move them, to make copies or delete them. The main interest of the new graphics mode is to make property change easier and to avoid cumbersome list of arguments in the graphics function calling sequence to set the properties.

This year work was devoted to improve this new graphics mode. After a debugging task, the team completed some missing object (surfaces, polylines...) properties. At the same time, another usefull tool issued : the graphic editor. Indeed this development, made in TCL/TK, allows us to change object properties without passing by the scilab console. 3-D plots merge were reviewed and fixed and deal with 2-D objects too. Finally the axes structure was totally rebuild to allow more editable properties.

## 4.6. Matlab To Scilab Conversion Toolbox

First work for M2SCI was to develop a new version, begun in June 2003, so that it could be used in Scilab 3.0, released in July 2004. The set of converted functions had to be improved so that basic Matlab scripts could be converted. The first functions that we wanted to convert automatically were Matlab primitives (hard

coded functions). Main non-graphics primitives have been implemented in conversion tools before Scilab 3.0 candidate release.

Then we had to implement Matlab 5 data types in Scilab, saying “struct” and “cell” types. These types have been emulated in Scilab using tlists. A basis already existed in Scilab 2.7 but cells (which can be considered as a particular type of struct) emulation was bad in many cases so we had to rewrite a big part of it copying and adapting struct emulation code. After this step, some tests has been written and improved to handle more cases and to verify Matlab compatibility.

The next step of this development should be the conversion of Matlab graphics. But Scilab graphics were not stable enough to start the conversion of Matlab graphics. So, automatic conversion of Matlab graphics could not be implemented before Scilab 3.0. One other important difficulty to port Matlab graphics to Scilab is that IHMs and graphics can not be printed in a single graphic figure what is possible with Matlab graphics. This point is not yet developed in Scilab and is a part that has to be planed for Scilab 4.0.

Scilab 3.0 has brought us one important thing we did not have for M2SCI: our users feedback. With this release we have come up with some bugs but also some user requests. Since July, M2SCI development has been split between bug correction and new functionalities implementation (new function conversion, particular cases...). This work has been realized jointly with some Scilab Consortium members really interested in converting their work to Scilab.

Jointly to this work, the dictionary of Matlab and Scilab equivalents has been updated with new automatically converted functions and this document is now available on Scilab Web site.

Documentation has been written to help future developments.

## 4.7. Interface with Excel

Pierrick Mode undergoes training in the team. He has developped and interfaced with Scilab C functions for reading text and numerical data of Excel file sheets. These functions, based on the Microsoft description of the Excel file format, can be used equivalently on Unix or Windows. The DDE interface can also be used under Windows to access (read or write) data in Excel files if Excel is available.

## 4.8. support

Other Developments and Support

- Command History for recording the running history of interactive Scilab sessions.
- Better integration of Scipad editor.
- The `diary` (used to rule the generation of session traces) and `history` tools, have been improved and rewritten in C.
- Scilab has been adapted to Itanium IA64 architecture.
- Little syntax, adaptations have been made to make the Matlab to Scilab translator work easier.
- Creation and Improvement of the Java <-> Scilab Interface. In particular this allows the use of Scilab as a computational engine in a JAVA environment.

Beyond its activity of development, the team brings its supports with the users. These relations with the users are a good way to improve the quality and the usability of the software.

## 4.9. Contributor Depository

A new contributor depository has been made on Scilab Web site. Now anyone can easily upload his contribution. A contribution database has been made and now downloading contributions is easier: it is possible to sort them.

## 4.10. Marketing

A market research was ordered to the INNOVATION company to understand the positioning of Scilab among the companies making scientific computations. 26 people from various companies have been interviewed and a report has been made. It gives very interesting information about the strategy of the future developments to make in Scilab.

## 4.11. Scilab License

An audit of Scilab code has been made by Celine Fontaine who undergoes a six months training in the team. She made a MySQL database of all Scilab files with the characteristics of the open source license of each file. She made a PHP code so that this database can be accessed by the team using a Web browser. Each time a new file is added in Scilab program, it is added in the database. This audit is very important to see if it is possible to change Scilab homemade license by a standard free software license such as GPL/LGPL.

# 5. Contracts and Grants with Industry

## 5.1. Scilab Consortium

After INRIA funding, the main funding of Scilab project comes from the dues given by the members who subscribe to Scilab Consortium.

The team has also a funding of the French Embassy in Beijing for the promotion of Scilab in China.

# 6. Other Grants and Activities

## 6.1. Consortium

- Claude Gomez: steering committee, 6 June 2004.
- Claude Gomez: assembly of Consortium participants, 24 June 2004.
- Claude Gomez: steering committee, 9 December 2004.

## 6.2. National Actions

- Participation to Salon Solutions Linux 2004, Paris, 3–5 February 2004.
- Allan Cornet, Hugues Perdereau: participation to “SCADE International User Group Conference 2004”, Toulouse, France, 25–26 October 2004.
- Serge Steer: Presentation of Scilab at the “Groupe Logiciel Universités - Recherche du ministère de la Recherche”, Paris, France, December 2004.

### 6.3. International Actions

INRIA and Scilab Consortium have organized on December 2nd and 3rd the first International Conference about Scilab “Scilab 2004” at INRIA Rocquencourt. Its purpose was to present and share studies, results developments, experiences and evolutions around Scilab software and toolboxes. The public of this conference was industrial people, researchers, teachers, user and developers of Scilab.

There were 41 presentations including 3 plenary sessions. There were the following sessions: Applications, Scicos, Large Scale Systems, Algorithms, Education, Toolboxes, Industrial Applications, PDE’s and Recent Advances.

There were 73 participants representing 39 different companies or establishments and a few people coming from outside of France (Switzerland, Spain, Greece, Belgium, China, Canada, Israel and USA).

- Claude Gomez, Serge Steer: visit to Moscow (Liapunov Institute, Institut of Numerical Mathematics, Institute for System Programming, Institute for Mathematical Modelling), 21–23 January 2004, Moscow, Russia.
- Claude Gomez: meeting about Scilab organized by the French Embassy, 29 April 2004, Berlin, Germany.
- Claude Gomez, Serge Steer: 2004 Scilab Contest Awards Ceremony, 19 October 2004, XiaMen, China.
- Claude Gomez: visit of Rosario University to set up a “Scilab Group”, 4 November 2004, Rosario, Argentina.
- François Delebecque, Hugues Perdereau: organization of “Scilab 2004” first Scilab Conference, 2–3 December 2004, Rocquencourt, France.

### 6.4. Visiting Scientists

- Winners of 2003 Scilab Contest: 5 Chinese professors and 5 Chinese students, 9–12 March 2004.
- Professor Li Zhiwei, Capital Normal University, Beijing: 1–3 December 2004.
- Winners of 2004 Scilab Contest: 5 Chinese professors and 5 Chinese students, 13–16 December 2004.

### 6.5. University Teaching

- Claude Gomez
  - Ecp: Dynamical Systems, 3rd year.
  - Pulv: Computer Algebra, Post Graduate.

### 6.6. Examination

- Claude Gomez: member of the board of examiners of “agrégation de mathématiques” in Morocco.
- Claude Gomez: member of the board of examiners of “olympiades de mathématiques de l’Académie de Versailles”

## 6.7. Conference and workshop committees, invited conferences

- Serge Steer: “Journées logiciels libres”, CEA, 26 janvier 2004.
- Claude Gomez, Ramine Nikoukhah, Serge Steer : “Scilab/Scicos logiciel libre de calcul scientifique, application à la simulation”, MICAD, Paris, 30–31 mars, 1 avril 2004.
- Claude Gomez: “Calcul formel et calcul numérique”, journées de l’UPS, Paris, 4 mai 2004.
- Claude Gomez: “Mathématiques et logiciels de calcul”, remise des prix des olympiades de mathématiques de l’académie de Versailles, 12 mai 2004. This conference has been recorded later and is available at “[didactheque](#)”.
- Thierry Cambois, Claude Gomez: “Scilab un logiciel libre de calcul scientifique, Retombées attendues chez PSA”, journée MICADO “Séminaire Organisation et rentabilité de la fonction Calcul”, Clamart, 3 juin 2004.
- Claude Gomez: “Scilab logiciel libre de calcul scientifique”, Journées du CUIC 2004 : “les logiciels libres”, Metz, 8–9 juin 2004.
- Claude Gomez: “Méthodes symboliques vs. méthodes numériques”, Cycle de conférences et ateliers “sensibilisation et formation aux outils de calculs, aux ressources numériques en ligne et aux nouvelles technologies”, Université de Montpellier, 22 juin 2004.
- Claude Gomez, Serge Steer: Scilab workshop at XiaMen University, XiaMen, China, 18–20 October 2004.
- Claude Gomez: “Herramienta de cálculo indispensable para el ingeniero” and panel discussion “Transferencia tecnológica, Herramientas y medios”, CLEIN 2004, Rosario, Argentina, 1–5 November 2004.
- Vincent Couvert: “Matlab to Scilab conversion tools”, Scilab 2004 International Conference, Rocquencourt, France, 2–3 December 2004.
- Fabrice Leray: “The new graphics”, Scilab 2004 International Conference, Rocquencourt, France, 2–3 December 2004.
- Claude Gomez: “Consortium, Scilab 4.0”, Scilab 2004 International Conference, Rocquencourt, France, 2–3 December 2004.
- Serge Steer: Scilab seminar at IRISA, Rennes, France, 9 December 2004. This conference has been recorded and will be available at Web site [Irisa](#).