Claude TADONKI CV

1 Civil information

First Name:	**Claude**
Middle Name:	**Martin**
Last Name:	**Tadonki**
Gender:	**male**
Date of birth:	**13 of June 1971**
Highest degree:	**PhD in Computer Science**
Affiliation:	**Mines ParisTech - CRI (Centre de Recherche en Informatique)** **Mathématiques et Systèmes**
Address:	**35, rue saint-honoré, 77305 Fontainebleau cedex (FRANCE)** **B.P. 34, F-91898 Orsay cedex (FRANCE)**
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Scientific membership:

- Member of the SPEEDUP Society, Swiss Forum of High Performance Computing
- Member of the Mathematical Programming Society
- Member of the European Association of Theoretical Computer Science

Personal URL: `http://www.omegacomputer.com/staff/tadonki`

2 Educational Background

2.1 Academic background

1990-1991:	Baccalaureat C	DLA
1992-1993:	DEUG in Mathematics and Computer Sciences	UY
1993-1994:	Bachelor in Computer Sciences	UY
1994-1996:	Master in Computer Sciences	UY
1996-1997:	DEA in Computer Sciences	UY/UR
1997-2001:	PhD in Computer Sciences *Contributions to Parallel Computing*	UR

UY: University of Yaoundé (Cameroon) UR: University of Rennes I / IRISA (France)

2.2 Summary research background

My research activities/interests (past and present) mainly includes *parallel computing, scientific computing, program design* and *optimization, linear algebra, operation research, combinatoric, and complexity*. After my Phd in parallel computing (at IRISA/INRIA) in 2001, I spent three years at the Operation Research Laboratory (University of Geneva), where I participated, within the LOGILAB scientific team, to the development of a convex optimization solver (Matlab/C) based on cutting planes and interior point methods. This work was dominated by linear algebra subroutines implementation and code coupling, in addition to theoretical investigations in smooth convex optimization and combinatorial approximation. This was followed by two years at the Algorithm and Complexity Laboratory, where I was involved with the design of novel robust algorithms for dynamical network and power aware computing. After that, I moved to the European Molecular Biology Laboratory (EMBL) at the Grenoble outstation, where I was concerned with mathematical modeling and computational engineering for radiation damage in X-ray synchrotron crystallography. This was an opportunity for me to work together with people from other disciplines related to matter structure study, and get familiar with experimental research and distributed high-throughput computing. Next, I joined the University of Paris-Sud(Orsay)/CNRS, working on automatic code optimization and deployment on various parallel architectures. Our aim was to understand, trough an intensive benchmark, the key point in the performance of parallel memory hierarchy machines. I next moved to a research fellow position at the LAL/IN2P3/CNRS(Orsay), working on *high performance computing* in particles physics. Our aim is to reach a petaflops performance for lattice Qantum Chromodynamics simulation. I currently hold a research position at the Mines ParisTech - CRI, working on HPC topics and automatic code transformations. I have published more than 35 papers in journals and international peer-reviewed conferences.

2.3 Technical skills

Spoken languages: French (native), English (fluent), and Spanish (fluent).

Scientific and technical topics: algorithm and complexity, applied mathematics, scientific and parallel computing, mathematical programming and operation research, software design and implementation, code parsing and automatic transformation, network/web modelling and analysis.

Operating systems: UNIX, Linux, Windows, DOS , Mac OS.

Programming languages: (Visual)Basic (excellent), (Visual, Borland)C/C++ (excellent), Fortran (excellent), Matlab (excellent), Java (basic), JavaScript/PhP (excellent), shell scripting (good).

Parallel Computing: MPI (excellent), PVM(basic), Condor(basic), OpenMP(normal).

Softwares developed (most important ones):
- *Universal Report* (Code Analysis Tool - C++ Builder - `http://www.omegacomputer.com/`)
- *ProxAccpm* (Convex Optimization Solver - Matlab - `https://projects.coin-or.org/OBOE`)
- *Markal Data Manager* (Energy Management System - Access and VB)
- *Hemisphere-Education* (Collection of Education Software - `http://www.hemisphere-education.com/`)
- *Matlab-Mex* (Automatic Matlab mex generator - `http://www.omegacomputer.com/staff/tadonki`)
- *Matlab-Cplex* (Library to call cplex from Matlab - `http://www.omegacomputer.com/staff/tadonki`)

Strengths:
- Excellent Communication skill to present points precisely and clearly
- Good problem solving ability and analytic skill to solve the problem efficiently
- Good team player and have excellent interaction skill to coordinate and work within a team
- Excellent Technical Skill and ability to handle different duties concurrently
- Good ability to collaborate with different find of partners (industry, research lab/team, ...)
- Have expertise in working with various programming languages and operating systems
- Good deliver output in less time without losing efficiency

3 Professional background

3.1 Positions

1997 - 2001	Junior Lecturer in Computer Sciences	University of Yde I
1999 - 2001	Junior Researcher at IRISA	University of Rennes
2001 - 2003	Senior Researcher (Optimization and related / Logilab)	University of Geneva
2003 - 2005	Senior Researcher and Lecturer (Theoretical Computer Science)	University of Geneva
2006 - 2007	Computing Scientist	EMBL Grenoble
2007 - 2009	Research Fellow (Program analysis and optimization)	University of Orsay
2009	Research Fellow (High Performance Parallel Computing)	LAL/IN2P3/CNRS Orsay

3.2 Teaching activities

I teach the following topics since 1997 at the University of Yaounde I and currently at the University of Geneva: *Advanced algorithmic*, *Complexity*, *Programming methods*, *Scientific computation*, *Linear algebra*, *Parallel algorithmic*, *Software design and implementation*, *Algorithmic for the web*, *Convex optimization*, *Message passing programming*, *Computer architecture*, *Operation research*, *First order logic*, *Programming languages*.

3.3 Academic supervising activities

2001:	Kronecker Product Implementations	Benedicte Kenmei (UY I)
2002:	Medical Database System	Lehner Godinho Bianca (UNIGE)
2003:	Sensor Network Localization	Benjamin Leveque (ENS Lyon)
2003:	Memory Power State Management	David Schenk (APM Technology)
2011:	High Level Optimization of the Dirac Operator	Tsemo Djoua (Master II research)
2012:	Memory Optimization and thread-parallelisation of the Dirac Operator	Wiktor Olko (Erasmus)

3.4 Projets participation

1996-2001:	Calcul Parallèle: Parallel Algorithms and Applications	University of Rennes
2001-2003:	Accpm: Design and Implementation of an Optimization Solver	University of Geneva
2001-2003:	SUTRA/NCCR: Urban Energy and Climate Modelling	University of Geneva
2003-2005:	CRESCCO: Critical Sharing Resources	University of Geneva
2006-2007:	BIOXHIT: European crystallography project	EMBL Grenoble
2007-:	TeraOps: Program modelling and optimization	University of Orsay
2007-:	Ocelle: Parallel Programming on the CELL Processor	University of Orsay
2002-Now:	Universal Report: Generic Documentation Software	Private
1996-Now:	Industrial Software Developpement Projects	Private

4 Scientific publications

4.1 Journal papers

1. **C. Tadonki**, and B. Philippe, *Parallel multiplication of a vector by a Kronecker product of matrices*, Parallel Distributed Computing Practices (PDCP), vol.2, No 4, pp. 53-67, 1999.

2. S. Rajopadhye, T. Risset, and **C. Tadonki**, *Le chemin algbrique sur rseaux linaires*, Technique et Science Informatiques (TSI), vol. 5, pp. 655-676,2001.

3. **C. Tadonki**, *A Recursive Method for Graph Scheduling*, Scientific Annals of Cuza University, Vol 11, p.121-131, 2002 .

4. **C. Tadonki**, and B. Philippe, *Parallel multiplication of a vector by a Kronecker product of matrices (part II)*, Parallel Distributed Computing Practices (PDCP), vol. 3, No. 2, pp. 337-346, 2000.

5. C. Beltran, **C. Tadonki** and J.-Ph. Vial, *Solving the p-median problem with a semi-Lagrangian relaxation, Computational Optimization and Applications*, Volume 35(2), October 2006.

6. F. Babonneau, C. Beltran, A. Haurie, **C. Tadonki** and J.-P. Vial, *Proximal-ACCPM: a versatile oracle based optimization method, Computational and Management Science*, Volume 9, 2007.

7. **C. Tadonki**, *Mathematical and Computational Engineering in X-Ray Crystallography*, International Journal of Advanced Computer Engineering, volume 1(2) 2008.

8. T. Saidani, L. Lacassagne, J. Falcou, **C. Tadonki**, Samir Bouaziz, *Parallelization Schemes for Memory Optimization on the Cell Processor : A Case Study on the Harris Corner Detector*, Transactions on High-Performance Embedded Architectures and Compilers, volume 3(3) 2008.

9. **C. Tadonki**, *Integer Programming Heuristic for the Dual Power Setting Problem in Wireless Sensors Networks*, Int. Journal of Advanced Research in Computer Engineering, vol 3(1) 2009.

10. **C. Tadonki**, G. Grodidier, O. Pene, *An efficient CELL library for lattice quantum chromodynamics*, ACM SIGARCH Computer Architecture News, vol 38(4) 2011.

4.2 Conference papers

1. **C. Tadonki**, *Systme d'quations rcurrentes et multiplication parallle d'un vecteur par un produit tensoriel de matrices*, 11e Rencontres francophones du parallélisme (Renpar'11), Rennes (France), 1999.

2. S. Rajopadhye, T. Risset, et **C. Tadonki**, *The algebraic path problem revisited*, Internation Conference on Parallel Computing (Europar), Toulouse (France), llncs Sringer-Verlag, N 1685, p. 698-707, August 1999.

3. **C. Tadonki**, *Ordonnancements canoniques*, Renpar12, Besanson (France), Juin 2000.

4. **C. Tadonki**, *Parallel Cholesky Factorization*, Workshop on Parallel Matrix Algorithms and Applications (PMAA), Neuchatel (Switzerland), August 2000.

5. **C. Tadonki**, et B. Philippe, *Mthodologie de conception d'algorithmes efficaces pour le produit tensoriel*, Colloques sur la Recherche en Informatique (CARI), Tananarive (Madagascar), Octobre 2000.

6. P. Quinton, **C. Tadonki**, and M. Tchuente, *Un chancier systolique et son utilisation dans l'ATM*, CARI2000, Tananarive (Madagascar), Octobre 2000.

7. C. Tadonki, *Complexit des ordonnancements canoniques et drivation d'architecture*, Renpar13, Paris (France), Avril 2001.

8. **C. Tadonki**, *A Recursive Method for Graph Scheduling*, Interantional Symposium on Parallel and Distributed Computing (SPDC), Iasi, Romania, July 2002.

9. L. Drouet, A. Dubois, A. Haurie and **C. Tadonki**, *A MARKAL-Lite Model for Sustainable Urban Transportation*, Optimization days, Montreal, Canada, May, 2003.

10. **C. Tadonki**, *ProxAccpm: A convex optimization solver*, International Symposium on Mathematical Programing, ISMP2003, Copenhagen, Danmark, August 2003.

11. **C. Tadonki**, M. Singh, J. Rolim and V. K. Prasanna, *Combinatorial Techniques for Memory Power State Scheduling in Energy Constrained Systems*, Workshop on Approximation and Online Algorithms (WAOA), WAOA2003 (LNCS/Springer), Budapest, Hungary, September 2003.

12. O. Briant, C. Lemarchal, K. Monneris, N. Perrot, **C. Tadonki**, F. Vanderbeck, J.-P. Vial, C. Beltran, P. Meurdesoif, *Comparison of various approaches for column generation*, Eight Aussois Workshop on Combinatorial Optimization, 5-9 january 2004.

13. **C. Tadonki** and J.-P. Vial, *Efficient algorithm for linear pattern separation*, International Conference on Computational Science, ICCS04 (LNCS/Springer), Krakow, Poland, June 2004.

14. R. Ndoundam, **C. Tadonki**, and M. Tchuente, *Parallel chip firing game associated with n-cube orientation*, International Conference on Computational Science, ICCS04 (LNCS/Springer), Krakow, Poland, June 2004.

15. C. Beltran, **C. Tadonki**, J.-P. Vial, *Semi-Lagrangian relaxation*, Computational Management Science Conference and Workshop on Computational Econometrics and Statistics, Neuchatel, Switzerland, April 2004.

16. **C. Tadonki**, C. Beltran and J.-P. Vial, *Portfolio management with integrality constraints*, Computational Management Science Conference and Workshop on Computational Econometrics and Statistics, Neuchatel, Switzerland, April 2004.

17. **C. Tadonki** and J. Rolim, *An analytical model for energy minimization*, III Workshop on Efficient and Experimental Algorithms, WEA04 (LNCS/Springer), Angra dos Reis, Rio de Janeiro, Brazil, May 2004.

18. **C. Tadonki**, *Universal Report: A Generic Reverse Engineering Tool*, 12th IEEE International Workshop on Program Comprehension, IWPC 2004, University of Bari, Bari, Italy, June 2004.

19. **C. Tadonki** and Jose Rolim, *An integer programming heuristic for the dual power management problem in wireless sensor networks*, 2nd International Workshop on Managing Ubiquitous Communications and Services, MUCS 2004, UDublin, December 13, 2004.

20. **C. Tadonki**, *Refinement experiments with RADDAM data*, EMBL bilateral meeting, Hamburg, Germany, June 26-28, 2006.

21. **C. Tadonki**, *Off-line settings in wireless networks*, 3rd International Symposium on Computational Intelligence and Intelligent Informatics, ISCIII2007, Agadir, Morocco, March 28-30, 2007.

22. T. Saidani, J. Falcou, **C. Tadonki**, L. Lacassagne, and D. Etiemble, *Algorithmic Skeletons within an Embedded Domain Specific Language for the CELL Processor*, Parallel Architectures and Compilation Techniques (PACT), PACT09, Raleigh, North Carolina (USA), September 12-16, 2009.

23. **C. Tadonki**, G. Grosdidier, and O. Pene, *An efficient CELL library for Lattice Quantum Chromodynamics*, International Workshop on Highly Efficient Accelerators and Reconfigurable Technologies (HEART) in conjunction with the 24th ACM International Conference on Supercomputing (ICS), pp. 67-71 (ACM Computer Architecture News), Epochal Tsukuba, Tsukuba, Japan, June 1-4, 2010.

24. **C. Tadonki**, L. Lacassagne T. Saidani, J. Falcou, K. Hamidouche, *The Harris algorithm revisited on the CELL processor* , International Workshop on Highly Efficient Accelerators and Reconfigurable Technologies (HEART) in conjunction with the 24th ACM International Conference on Supercomputing (ICS), pp. 97-100 (ACM Computer Architecture News), Epochal Tsukuba, Tsukuba, Japan, June 1-4, 2010.

25. **C. Tadonki**, *Ring pipelined algorithm for the algebraic path problem on the CELL Broadband Engine*, Workshop on Applications for Multi and Many Core Architectures (WAMMCA 2010) in conjunction with the International Symposium on Computer Architecture and High Performance Computing (SBAC PAD 2010) (IEEE digital library), Petropolis, Rio de Janeiro, Brazil, October 27-30, 2010.

26. **C. Tadonki**, *Large Scale Kronecker Product on Supercomputers*, 2nd Workshop on Architecture and Multi-Core Applications (WAMCA 2011) in conjunction with the International Symposium on Computer Architecture and High Performance Computing (SBAC PAD 2011) (IEEE digital library), Vitria, Esprito Santo, Brazil, October 26-29, 2011.

27. D. Barthou, G. Grosdidier, M. Kruse, O. Pene and **C. Tadonki**, *QIRAL: A High Level Language for Lattice QCD Code Generation*, Programming Language Approaches to Concurrency and Communication-cEntric Software (PLACES'12), 31st March 2012, Tallinn, Estonia.

28. **C. Tadonki**, *Basic parallel and distributed computing curriculum, Second NSF/TCPP Workshop on Parallel and Distributed Computing Education (EduPar?12) in conjunction with the 26th IEEE International Parallel & Distributed Processing Symposium (IPDPS), Shanghai, China, May 21-25, 2012.*

29. **C. Tadonki**, L. Lacassagne, E. Dadi, M. Daoudi, *Accelerator-based implementation of the Harris algorithm, 5th International Conference on Image Processing (ICISP 2012), Agadir, Morocco, June 28-30, 2012.*

30. E. Dadi, M. Daoudi, **C. Tadonki**, *3D Shape Retrieval using Bag-of-feature method basing on local codebooks, 5th International Conference on Image Processing (ICISP 2012), Agadir, Morocco, June 28-30, 2012.*

4.3 Chapter of book

1. *Ordonnancement pour l'informatique parallèle*, A. Moukrim and C. Picouleau (Editors), HERMES SCIENCE PUBLICATIONS, 2003.

4.4 Technical reports

1. **C. Tadonki**, and B. Philippe, *Parallel multiplication of a vector by a Kronecker product of matrices*, IRISA report n 1194, 1998.

2. P. Quinton, **C. Tadonki**, and M. Tchuente, *Un chancier systolique et son utilisation dans l'ATM*, IRISA report n 1348, 2000.

3. **C. Tadonki**, Synthse d'ordonnancements parallles par reproduction canonique, IRISA report n 1349, 2000.

4. D. Cachera, S. Rajopadhye, T. Risset, and **C. Tadonki**, *Parallelization of the algebraic path problem on linear simd/spmd arrays*, IRISA report n 1409, 2001.

5. **C. Tadonki** and J.-P. Vial, *The linear separation problem revisited with accpm*, Cahier de Recherche n 2002.11, University of Geneva, June 2002.

6. F. Babonneau, C. Beltran, O. du Merle, **C. Tadonki** and J.-P. Vial, *The proximal analytic center cutting plane method*, Technical report, Logilab, HEC, University of Geneva, 2003.

5 Conference participations and visitings

1997	CANADA (Montreal and New-Brunswick)	Workshop
1997	FRANCE (Rennes and Grenoble)	Visiting
1998	SENEGAL (Dakar and Goree)	Colloqium
1999	FRANCE (Rennes) BELGIUM (Bruxelles) GERMANY (Hannover)	Visiting
1999	MORROCO (Oujda)	Symposium
2000	FRANCE (Rennes, Besancon, Strasbourg)	Visiting
2000	SWITZERLAND (Geneva and Neuchatel)	Visiting and Workshop
2000	MADAGASCAR (Tananarive)	Colloqium
2001	GREECE (Athens and Thessaloniki)	Workshop
2002	SWITZERLAND (Lausanne and Zinal)	Workshop
2002	ROMANIA (Bucarest and Iasi)	Symposium
2002	SPAIN (Barcelona)	Visiting
2003	SWITZERLAND (Grimmentz and Lausanne)	Workshop
2003	ITALIA (Milano)	Visiting
2003	GREECE (Santorini)	Workshop
2003	DANMARK (Copenhagen)	Symposium
2003	HUNGARY (Budapest)	Symposium
2003	USA (Washington / New-York)	Visiting
2003	GREECE (Athens)	Workshop
2004	ITALY (Verona)	Workshop
2004	BRAZIL (Rio de Janeiro)	Workshop
2004	ARGENTINA (Buenos Aires)	Visiting
2004	ITALY (Bari)	Workshop
2004	MORROCO (Casablanca)	Visiting
2004	AUSTRIA (Viena)	Visiting
2004	UK (London)	Visiting
2004	IRELAND (Dublin)	Workshop
2005	UK (Bristol)	Invited speaker
2005	UK (Cambridge)	Invited speaker
2005	PORTUGAL (Lisbon)	Invited speaker
2005	UK (Liverpool)	Meeting
2006	GERMANY (Hamburg)	Meeting
2007	MORROCO (Agadir)	Conference
2007	GERMANY (Heidelberg)	Meeting
2010	JAPAN (Tsukuba)	Meeting
2010	BRAZIL (Rio de Janeiro)	Meeting
2011	FINLAND (Helsinki)	Meeting
2011	BRAZIL (Vitori)	Conference
2011	MEXICO (Mexico)	Meeting
2010	CUBA (La Habanna)	Visiting
2012	EGYPT (Cairo)	Teaching
2012	CHINA (Shanghai)	Conference
2012	INDIA (New Delhi)	Conference

6 Research topics

6.1 Parallel Computing

Parallel computing is an alternative to achieve a high performance computation. The basic idea is to use several interconnected cpus to solve a given problem. Of course the first step is to design a parallel algorithm. The task is rarely trivial, even for "simple" problems. The reason of this is the dependence exploration task that should be analyzed carefully, and the cooperation of computing entities that should be described explicitly (tasks allocation, communications, synchronizations, etc...). The target problem can be specified and analyzed using a task graph model, recurrence equations, algebraic modeling, and other. Implementing a parallel algorithm is a delicate task. In a technical point of view, actual parallel computers provide high computing power that can

be exploited in order to accomplish complex tasks. A significant step has been also achieved in the direction of languages, compilers, and processors communication management. Research activities in the area of parallel computing are particularly active (many research centers, conferences, symposium, workshops, journals). Nowadays, with the advent of multi-core architectures, parallel/distributed computing will become pervasive even for common issues.

6.2 Combinatorial optimization

Mathematical optimization is a key topic in computer science, applied mathematics, and operation research. There is a wide range of well-known techniques for tackling or solving combinatorial problems. Combinatorial optimization combines techniques from combinatorics, mathematical programming, and the theory of algorithms, to solve optimization problems over discrete structures. There is a long list of combinatorial problems that are subject to intensive researches: Traveling salesman problem, hamiltonian path, scheduling, graph coloring, bin packing, knapsack, maximum clique, k-median, matching problems, and more. Most of these problems are hard to solve in general. Thus, it is customary to take into account the specificity of some particular and pertinent instances in order to derive solutions that can be used in practice. Current researches continue to improve the impact existing paradigms, bring up new concepts, and propose alternative formulations of challenging problems.

6.3 Scientific computing

Scientists and engineers are now involved with more and more challenging computations in their activities. Writing a semantically correct algorithm is one thing, while providing good performance is another. Modern computational methods should fit the requirement of acceptable time (and/or memory) complexity, with a special care about the accuracy. There are several domains in which the need of high performance computing is unquestionable. It is the case for numerical mathematics, large scale optimization, image processing, astronomy calculations, meteorological predictions, nuclear physics, and more. The aim is to provide a real-time processing even if the problem is fundamentally complex and implies a huge amount of data. Efficient program design and the computation power of actual supercomputers are great technical contributions toward this purpose (see Top500 Supercomputer Site).

6.4 Algorithm and complexity

Designing efficient algorithms and provide a rigorous analysis of their complexity is a major topic in computer science. Of course the way an algorithm is implemented determines its effective efficiency, specially the choice of appropriate data structures. Significant results on the absolute complexity of important problems give the limit of what can be expected. When a given problem is state to be difficult, it is customary to turn to approximation algorithms. In that case, there is a tradeoff between the quality of the solution and the time complexity. Current algorithmic and complexity researches are concerned with sorting, searching, graph problems, number theory, game theory, artificial intelligence, image processing, geometry, discrete optimization, and more.

6.5 Energy efficient computation

In recent years, the design tradeoff of performance versus power consumption has received much attention because of

- the emergence of embedded systems.
- the large number of mobile systems that need to provide services with the energy releasable by a battery of limited weight and size;
- the technical feasibility of high-performance computation due to heat extraction;
- concerns about the operating costs of large systems caused by electric power consumption.
- new technology features for explicit power management.

Recent design methodologies and tools have addressed the problem of energy-efficient design, aiming to provide system realization and fast implementation while reducing the power dissipation. Energy/power optimization under performance constraints (and vice versa) is both hard to formulate and solve in general, when considering all degrees of freedom in system design and algorithm synthesis. The topic of energy reduction is being investigated at all levels of system abstraction, from the physical layout to software design. There are three major constituents of hardware that consume energy, namely computation, communication, and storage units. Advanced memory architectures support multiple power states of memory banks, which can be also exploited to reduce energy dissipation in the system. All these features can be taken into account at higher levels including scheduling and precompilation. Data partitioning, storage remapping, explicit I/O management, and algorithmic processing can be separately or jointly consider for energy performance improving. Energy efficient design is now one of the key points in modern computation.

6.6 Wireless Network modeling and algorithms

Recent advancements in wireless communications and electronics have enabled the development of low-cost sensor networks. A sensor is an electronic device that measures some physical quantity and reports it. Emerging technologies such as MicroElectroMechanical Systems (MEMS) have made sensors smaller and cheaper. A sensor network is composed of a large number of sensor nodes that are densely deployed either inside the phenomenon or very close to it. The position of sensor nodes need not to be engineered or predetermined. This allows random deployment in inaccessible terrains or disaster relief operations. The sensor networks can be used for various application areas (health, military, home, environmental, exploration, tracking, and more). For different application areas, there are different technical issues that researchers are currently trying to solve. Sensor networks represent a significant improvement over traditional sensors. Nowadays, we are really surrounded by sensor networks, and this intensive use requires some issues to be revisited for necessary improvements. It is the case of the localization problem, the energy optimization both in computation and communication, and also in the internal operating system of sensors. Existing protocols need to be improved, and new ones are to be developed in order to fit actual requirements like real-time processing and fault-tolerance. In general, in wireless networks, transmissions are performed in a multi-hop manner. This raises several graph problems that need to be solved, preferably with distributed approaches, for monitoring purposes or related. Another interesting topic is the range assignment problem. Indeed, in a wireless network, each element is a transmitter/receiver, and communication between two elements is possible either directly within their respective ranges, or by multi-hop transmissions otherwise. In the later case, communications can impact serious amount of energy, which is a critical resources in wireless network. Consequently, energy-efficient protocols are of a particular interest. The problem can be studied in a technical point of view, or with combinatorial/geometrical approaches.

6.7 Reverse engineering

While or after writing an important set of codes, provide and maintain the corresponding documentation is crucial and quiet helpful. This document helps to understand the program both in its global structure and its internal details. Regardless of the intent of its author, all source code is eventually reused, either directly, or just through the basic need to understand it by other parties. Without documentation, the only way to get the needed information is to make intuitive assumption, analyze the implementation, or interrogate the author. These alternatives are unpractical. There are mainly two ways of producing a documentation from a set of source codes. One way is to write a static and independent documentation, means its content follows from the source codes at a given state. In this case, there is no *dynamic link* between the statements in the program and the corresponding items in the documentation. Such static documentation is difficult to maintain, and is not updated as frequently as necessary because of this mechanical aspect of the task. Consequently, as time is going on, the gap between the source codes and the documentation will be so important that this documentation will become obsolete. An efficient way to easily get a detailed and up-to-date documentation is to build a high level document structure and let its items being instantiated automatically. This approach clearly needs a so called *automatic source code documentation tool*. Assuming a well documented program, such a tool should be able to extract meaningful source code comments and global structure to create a complete and

understanding external documentation. This topic is a fundamental engineering practice critical to efficient software development.

6.8 Data analysis in synchrotron crystallography

The interests lie in the improvement of synchrotron X-ray macromolecular (MX) data collection techniques to aid structural biologists in their quest for detailed atomic structures used for understanding biological functions of macromolecules. The Instrumentation Group develops hardware, software and novel methodologies for data collection and phasing. An ongoing development of methods in crystallography has been the characterization, mitigation and utilization of radiation damage in MX. The intense undulator synchrotron radiation of 3rd generation synchrotrons rapidly damages the fragile, cryocooled, crystalline macromolecules. Part of our research aims to get an improved understanding as well as a better crystallographic treatment of radiation damage.