8/ GraphComb

Graph Theory and Combinatorial Optimization

équipe Théorie des Graphes et Optimisation Combinatoire

Responsable: Abdel Lisser

L'équipe fut l'une des composantes initiales du LRI, lors de sa création il y a plus de trente ans. Ses principaux domaines d'études sont la théorie des graphes et l'optimisation combinatoire. Ses domaines d'application sont principalement les réseaux de télécommunication et récemment l'optimisation de la production d'électricité. L'équipe s'intéresse également à l'algorithmique discrète et aux problemes liés à la complexité. L'équipe est très active et très productive, comme en témoignent sa longue liste de publications scientifiques dans des journaux ainsi que dans les actes de conferences, la participation de ses membres à de nombreux comités de programmes de conférences, et leurs nombreuses invitations dans des rencontres et séminaires internationaux.

L'équipe a une approche plutôt fondamentale des problèmes scientifiques. Cependant, ceci ne se fait pas au détriment de collaborations industrielles, comme en témoignent plusieurs participations à des projets ANR, ainsi qu'à une participation à un projet europeen IST. Le recrutement récent de Cedric Bentz permet de renforcer le thème optimisation combinatoire de l'équipe. Ce recrutement ne compense guère les départs à la retraite de trois membres de l'equipe : Odile Favaron, Marie-Claude Heydemann et Maryvonne Maheo, la mutation en 2007 de Pierre Fraigniaud à Paris 7 et le départ de Pascal Berthomé comme professeur à l'ENSI de Bourges. L'équipe les remercie pour leurs efforts et leur souhaite beaucoup de succàs dans leur nouvelle carriàre. En plus, un autre départ à la retraite est prevu en 2009. Ces départs effectifs et prévus ont un impact considérable sur le fonctionnement scientifique de l'équipe.

Au moment où notre équipe fait face à de nouveaux défis en orientant sa recherche fondamentale vers de nouveaux domaines, i.e. modélisation du risque, optimisation combinatoire stochastique et les réseaux sensoriels, remplacer quelque uns des collègues partants est plus que jamais vital afin de pouvoir mener à bien ces nouveaux projets passionnants.

Graph Theory and Combinatorial Optimization

Head: Abdel Lisser

GraphComb

As one of the founding members of LRI, the group goes back more than 30 years. The main themes of our group remains graph theory and combinatorial optimization, with applications to network design and recently to electricity planning optimization. The group is very active and productive, as illustrated by the large number of scientific contributions in the leading international journals and international conferences, and by its member's participation in several conference program committees as well as by numerous invitations to international conferences and seminars.

The group addresses problems that are mostly of fundamental flavor. Nevertheless, we also collaborate with industry, as illustrated by several participations in national ANR projects and one european IST project. The recent recruitment of Cedric Bentz in 2007 allows reinforcing combinatorial optimization theme of our group. However, this appointment does not balance three retirements of Odile Favaron, Marie-Claude Heydemann and Maryvonne Maheo in 2003 and 2004 respectively, the transfert of Pierre Fraigniaud to the University of Paris VII and the promotion of Pascal Berthome as Professor at ENSI of Bourges. The team thanks them for their appreciated efforts and wishes them great success in their new positions. Moreover, an additional retirement is planned for this year. While considering that all those colleagues contributes either by a dozens of high level journal papers and consistant projects in the life of group, their leaving will definitely create a significant overthrow in the scientific life of the group.

At the moment where our group is facing new challenges by turning his fundamental research towards new areas, namely risk modeling, combinatorial stochastic optimization and sensor networks, replacing some of the leaving colleagues is more than ever crucial to carry through those new exciting projects.

Research Group Members

Permanent faculty (1 october 2008)			
Name	*First name*	*Position **	*Institution*
BENTZ	Cédric	MCF	PARIS 11
DELORME	Charles	MCFHC	PARIS 11
DJELLOUL	Selma	MCF	PARIS 12
FAYARD	Didier	PREX	PARIS 11
FLANDRIN	Evelyne	PR1	PARIS 5
FORGE	David	MCF	PARIS 11
KOUIDER	Mekkia	MCFHC	PARIS 11
LI	Hao	DR2	CNRS
LISSER	Abdel	PR1	PARIS 11
SACLE	Jean-François	MCF	PARIS 11

Doctoral students (1 october 2008)			
Name	*First name*	*Position **	*Institution*
ADAMUS	Lech	Grant	PARIS 11
CHEN	Meirun	Grant	PARIS 11
KOSUCH	Stefanie	A	PARIS 11
LE BODIC	Pierre	A	PARIS 11
LETOURNEL	Marc	civil servant	PARIS 11
LIU	Li	Grant	PARIS 11
LOPEZ	Rafael	AM	PARIS 11
OUATIKI	Saliha	Grant	PARIS 11
PABLO ALBERTO	Adasme	A	PARIS 11
YANG	Yi	Grant	PARIS 11
ZHU	Yan	Grant	PARIS 11

Temporary personnel (2005-2008)					
Name	*First name*	*Position **	*Institution*	*Arrival*	*Departure*
DORBEC	Paul	ATER Post-Doc	PARIS 11	07.2008	

Visitors for 3 months or more (2005-2008)					
Name	*First name*	*Position **	*Institution*	*Arrival*	*Departure*
BEKKAI	Siham	Ph.D. student	USTHB Alger	09.2007	08.2008

* *See the glossary for the acronyms.*

Group evolution

The GraphComb team is currently composed of 3 Professors, 6 Assistant-Professors and one CNRS Research Director. Our team composition has changed for the last four years as follows: Pierre Fraigniaud moved to University of Paris VII at the end of 2006, Pascal Berthomé was promoted to Professor in the School of Engineers of Bourges in January 2008 and Cédric Bentz was hired as an Assistant-Professor in September 2007.

Highlights

The GraphComb Team contributes significantly to the areas of graph theory, network algorithms and combinatorial optimization. Our work was published in the most prestigious journals (JCTB, JGT, DM, Management Science, ANOR...) and also in selected international conferences (PODC, ESA,ICALP...). Team members participated to several program committees for international conferences (DISC, SPAA, NCP, ICGT, MCO) and also served as editorial board members for international journals (Distributed Computing, Theory of Computing Systems, ACKP, 4OR...). Our team produced the following major results, according to our objectives:

- We disproved the Hedetniemi et al. conjecture, related to the domination subdivision number of a given graph.
- In digraph coloring, we provided a significant improvement towards the proof of the El Sahili conjecture.
- We obtained sufficient conditions for existence in a graph of cycles of given length, including the Hamiltonian problem.
- We studied heterochromatic sub-graphs. By using a newly defined color-degree for every vertex, we obtained several results with sufficient conditions concerning the existence of heterochromatic matchings and cycles with given sizes and as well as results on alternative cycles.
- We obtained fundamental results in Wireless Sensor Networks and connectivity of graphs. We also provided related algorithms.
- We studied the complexity multicut minimum problem and proved that some variants are NP-complete or APX-hard in the case of oriented graphs.
- We provided different methods for obtaining tests for the detection of presence of some structures in a graph.
- We proposed a new cutting plane algorithm for solving semidefinite relaxations of the quadratic assignment problem.
- We studied stochastic quadratic knapsack problems with simple and complete recourse. We proposed semidefinite relaxations for two-stage stochastic knapsack problems with probability constraints for discrete distributions. We proposed new methods for solving stochastic knapsack problems with continuous distributions.
- We proposed a new perspective on the small world phenomenon by considering arbitrary graphs augmented according to distributions guided by tree decompositions of the graphs.

Key Publications

- E. Flandrin, H. Li, A. Marczyk, I. Schiermeyer, and M. Wozniak. Chvatal-erdos conjecture and pancyclism. *Discussiones Mathematicae Graph Theory*, 26:335–342, 2006
- P. Fraigniaud. A new perspective on the small-world phenomenon: Greedy routing in tree-decomposed graphs. In *13th Annual European Symposium on Algorithms (ESA)*, number 3669 in LNCS, pages 791–802, September 2005
- R. Andrade, A. Lisser, G. Plateau, and N. Maculan. Enhancing a branch and bound algorithm for two-stage stochastic integer network design based models. *Management Science*, 9:1450–1455, 2006

- D. Cardoso, J. O. Cerdeira, P. da Silva, and C. Delorme. Efficient edge domination in regular graphs. *Discrete Applied Mathematics*, 156 (15):3060–3065, 2008

Research Description

The Graph Theory and Combinatorial optimization team research covered a number of topics over the $2005-08$ period; including graph theory and matroids, communication networks algorithms, combinatorial and stochastic optimization and Monadic Second-Order Logic and Recursively Decomposable Graphs.

Graph Theory and Matroids

Graph theory spans a variety of topics; we focus on coloring and domination, cycles, paths, and factors, algebraic methods in graphs and logic.

Coloring and domination Let χ (χ') be the classical proper vertex (edge) chromatic number of a graph (the color classes are independent sets of vertices or edges). We proved that, for any $k \geq \chi'$, any graph G has a balanced proper edge coloring by k colors. In k-vertex-chromatic oriented graphs, we established the existence of special oriented paths of length $k-2$, thus yielding a very short proof of Roy-Gallai result, and we extended a result of Saks and Sós to the tournament-like digraphs.

We also studied different variants of coloration parameters related to vertices or edges. The *b-chromatic number* $b(G)$ of a graph G is the maximum number of classes in a proper vertex coloring such that for each color i, there exists a vertex colored by i, adjacent with at least one vertex in each of the other color classes. We established relations between $b(G)$ and other parameters of the graph (such as the degrees, or the stability number) and gave bounds on $b(G)$ in some classes of graphs, for instance products of graphs, $K_{1,t}$ -free graphs, and bipartite graphs. We determined some classes of b-perfect graphs (graphs G such that $\chi(H) = b(H)$ for each induced subgraph H of G).

We showed that a conjecture of Burris and Schelp (1993) related to $\chi'_s(G)$, the minimum number of colors in a proper coloring of the edges of G such that any two vertices are incident with different sets of colors, is true in graphs of sufficiently large degrees. This is the best result on this conjecture till now. Given a graph G and an edge coloring of G, a heterochromatic (alternating, resp.) subgraph of G is a subgraph in which any two (adjacent, resp.) edges have distinct colors. We obtained various results on heterochromatic or alternating matchings and cycles.

Building upon our previous work, we obtained new results related to different variants of domination as connected, paired or total domination, with emphasis on k-domination (each vertex is covered at least k times) [20, 19, 25, 16]. We also began the investigation of the effect of the subdivision of an edge on various domination numbers: the problem is to study $sd_{\gamma(G)}$, the minimum number of edges to subdivide in order to increase the domination number [21, 24]. Our efforts to try to prove a conjecture on $sd_{\gamma(G)}$ proposed in 2001 finally lead to the construction of a counter-example but gave us as byproducts interesting bounds related to $sd_{\gamma(G)}$ and similar parameters for different kinds of domination.

Finally, in the context of graph polynomials, we defined a new strategy for computing the chromatic polynomial of any graph. We defined a technique based on graph triangulations, leading to a new graph representation on which the elementary operations needed for the computation are easy to implement. This structure, called *augmented clique trees* explicitly shows some distance of the initial graph to the class of chordal graph, for which the chromatic polynomial is known.

Cycles, paths and factors The Hamiltonian problem, i.e. the existence in a graph of a cycle passing through every vertex exactly once, is one of the oldest problems in graph theory. We obtained a partial result on a conjecture on Hamiltonian graphs that is related to the independence number and to connectivity. We also obtained conditions for Hamiltonian cycles or for pancyclism in some special families of graphs as generalized prisms [60].

One generalization of the above concepts is to consider cycles, paths or special structures through given vertices (cyclability) or through given edges. We proved many results in this area, using different types of conditions: closure properties, forbidden subgraphs or “regionalisation" of well known conditions.

Another related problem consists of covering the vertices of a graph with a minimum number of cycles of prescribed lengths or with a given number of cycles. Let $c_k(G)$ be the minimum number of cycles of length at most k necessary to cover the vertices of G. We bounded $c_k(G)$ in function of the minimum degree or of the stability number of G. If the cycles are disjoint, they form a 2-factor. In general graphs there is no 2-factor, and the problem is to determine, or bound, the maximum number of vertices covered by disjoint cycles in function of other parameters of the graph (degrees, stability number). So we generalized a result of Niessen on 2-factors.

We also obtained sufficient conditions on the stability number and the connectivity of a graph for the existence of an (a,b)-factor (spanning subgraph such that every vertex has degree included between a and b) and we disproved a conjecture of Kano and proved a reformulation of this conjecture.

Algebraic methods Extending the interesting Erdős-Rényi construction, we obtained a new graph of diameter 2, thus improving our table of large graphs with given diameter and maximum degree. We applied spectral methods to partition graphs (minimisation and maximisation of the size of the set of edges between the parts), or to disprove the existence of special systems of vertices or edges in the graph. We are also currently investigating spectral methods to prove the non-existence of some graph morphisms (a generalization of coloration problem), and to number the partitions of a given graph into connected parts.

Orlik-Solomon algebras were defined to study the topology of the complement of a hyperplane arrangement. We established some relations between the properties of the matroids and those of these algebras. A gain graph can be seen as a representation of some special cases of arrangements. Its study is in direct relation with properties of the corresponding arrangement such as its characteristic polynomial. We answered some questions on gain graphs, similar to those on classical graphs, as counting colorations or finding universal constructions.

Monadic Second Order Logic We began investigating Monadic Second Order Logic in the middle of 2004. During the past two decades, the contributions of researchers working with different approaches, some dealing with formal languages and logics (Courcelle), other dealing with combinatorics in graphs (Robertson and Seymour), gave rise to strong connections between the significance of apparently independent results all concerning what is now known as "classes of recursively decomposable graphs". In the context of graph grammars and graph logic, we proved properties of preservation of HR-equationality and MS_1 and MS_2-definability (these are two variants of monadic second-order logic on graphs) for the graph cartesian product operation.

Algorithms and Combinatorial optimization

Distributed Computing We focused on three complementary aspects of distributed computing: information retrieval, social network analysis, and mobile computing.

In the domain of information retrieval, we included the design of overlay networks for file sharing peer-to-peer systems. The overlay D2B is based on the de Bruijn graph, enabling similar performances as Chord for publish/lookup and join/leave, but maintaining a constant number of connections per node only. The overlay network QRE combines the use of clustering and scale-free nature of user exchanges into a simple and efficient P2P system [35].

In the domain of social network analysis, we focused on an analysis of the Milgram Experiment performed in the 60s, and on the Augmented Graph Model proposed by Jon Kleinberg in 2000. Our main contributions include an analysis of navigability in multi-hierarchical networks (geographical, societal, etc.), and the design of lower bounds on the navigability properties of networks.

Finally, in the domain of mobile computing, we tackled the graph searching problem and the graph exploration problem. We analyzed the performance ratio between connected graph searching and (standard) graph searching. We set of memory bounds for graph exploration with finite automata.

Combinatorial and stochastic Optimization Our research in combinatorial stochastic optimization has been reinforced over the last four years. We studied and solved different stochastic optimization problems in telecommunication network design. We proposed a framework for handling uncertainty in wired network design and we implemented different approaches for solving optimality in medium-size real instances; namely Branch and Bound, and Branch and Cut, with the embedded lift and project method [3, 2]. We modeled stochastic network design optimization problems as two-stage optimization problems. In wireless networks, we also considered traffic and interferences uncertainty while solving the well known GSM frequency assignment problems [83]. We proposed new formulations based on both semidefinite programming and the decomposition L-Shaped method. We solved this problem by considering a simple recourse and handled simulations showing that we can derive SDP lower bounds for stochastic Frequency Assignment problem. For CDMA detection problems (third generation wireless networks), we proposed a combination of SDP relaxation for deriving lower bounds and VNS scheme for computing upper bounds [77, 65]. In order to handle risk aversion in combinatorial optimization, we studied stochastic optimization problems with probabilistic contraints, namely the stochastic quadratic knapsack problems with $0-1$ variables [69, 80]. We proposed new formulations based on SDP relaxations for the following cases: probabilistic constrained knapsack problem with a simple recourse and its counterpart with complete recourse. All stochastic optimization problems described above are based on discrete probability distributions. For stochastic chance constrained knapsack problems with a

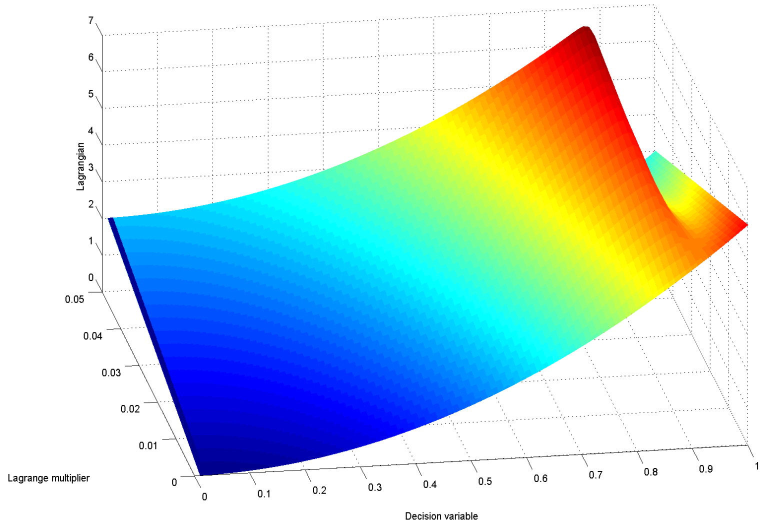


Figure 8.1: Stochastic Gradient Method

continuous distribution, we developed stochastic gradient approaches (see figure 8.3.2) embedded in the Branch and Bound scheme to derive optimal solutions.

In robust optimization, we studied robust versions of the multicut problem, and showed that some results known for the basic problem remain true for these more general variants, while some other do not. We also studied some problems of robustness in evolving network topologies. We considered evolving network topologies, where the network grows periodically. We showed that this problem becomes difficult (NP-Hard) to solve whenever we associate a cost to any change on the route. We also defined some approximation algorithms for this problem.

In deterministic combinatorial optimization, we obtained many results about the complexity and approximation of some routing and partitioning problems, more precisely multicut (or multiterminal cut) problems, and integer multiflow (or multiterminal flow) problems. We proved the polynomial-time solvability of these problems (and of some variants) in several natural classes of graphs: rings, some families of meshes, etc. We also showed several hardness results in bounded tree-width (di)graphs for the multicut problem. Finally, we studied the approximation of multiflow and multiterminal flow problems, and improved or generalized some known results.

We studied the multi-terminal flow problem with some parametrized capacities. In 1960, Gomory and Hu defined the so-called Gomory-Hu cut tree. Based in this approach, we showed that if there exists some capacity of the network that is unknown in advance, finding any max flow value for any triple source-destination-capacity can be determined in linear time using two Gomory-Hu cut trees.

Finally, we studied the Quadratic Assignment Problem. We proposed a cutting plane algorithm based on semidefinite programming. We derived lower bounds for large size instances with up to $n = 70$ variables. The state of the art for this problem is $n = 30$ [84].

Sidebar

Stochastic Knapsack Problem with random weights

We consider a stochastic knapsack problem of the following form: Given a set of n items where each item has a weight that is unknown in advance. We consider the weights as random variables and assume that weight χ_i of item i is independently normally distributed with mean $\mu_i > 0$ and standard deviation σ_i. The capacity of the knapsack is deterministic parameter $c > 0$. Furthermore, each item has a predetermined reward per weight unit $r_i > 0$. We denote by χ, μ, σ and r the corresponding n-dimensional vectors.

Our aim is to maximize the expected total reward $\mathbb{E}[\sum_{i=1}^{n} r_i \chi_i x_i]$. Due to the stochastic nature of the weights, the stochastic knapsack problem can be formulated in different ways:

Stochastic Knapsack Problem with simple recourse

$$\max_{x\in\{0,1\}^n} \mathbb{E}[\sum_{i=1}^{n} r_i \chi_i x_i] - d \cdot \mathbb{E}[[g(x,\chi) - c]^+] \tag{8.1}$$

The Chance Constrained Knapsack Problem

$$\max_{x\in\{0,1\}^n} \mathbb{E}[\sum_{i=1}^{n} r_i \chi_i x_i] \tag{8.2}$$

$$\text{s.t.} \quad \mathbb{P}\{g(x,\chi) \le c\} \ge p \tag{8.3}$$

or equivalently

The Expectation Constrained Knapsack Problem

$$\max_{x\in\{0,1\}^n} \mathbb{E}[\sum_{i=1}^{n} r_i \chi_i x_i] \tag{8.4}$$

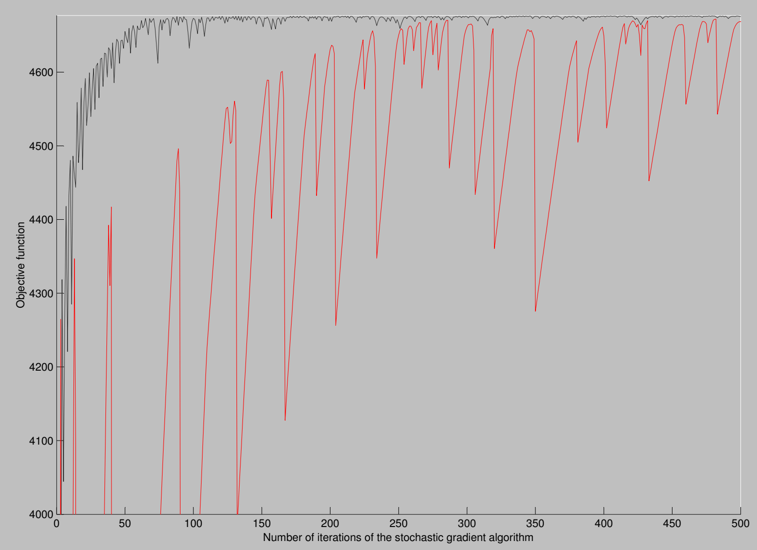
$$\text{s.t.} \quad \mathbb{E}[\mathbb{1}_{\mathbb{R}^+}(c - g(x,\chi))] \ge p \tag{8.5}$$

where $\mathbb{P}\{A\}$ denotes the probability of an event A, $\mathbb{E}[\cdot]$ is the expectation function, $\mathbb{1}_{\mathbb{R}^+}$ denotes the indicator function of the positive real interval, $g(x,\chi) := \sum_{i=1}^{n} \chi_i x_i$, $[x]^+ := \max(0,x) = x \cdot \mathbb{1}_{\mathbb{R}^+}(x)$ $(x \in \mathbb{R})$, $d \in \mathbb{R}^+$ and $p \in (0.5, 1]$ is the prescribed probability.

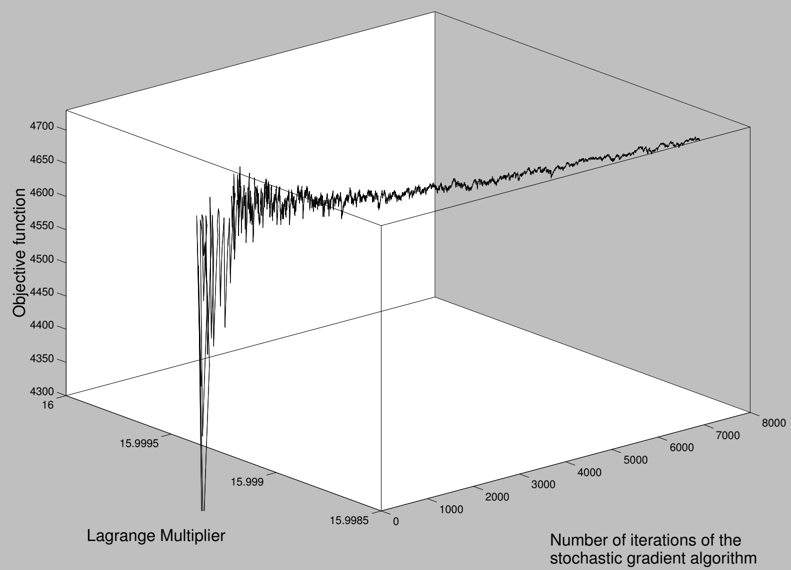
We propose different solution approaches for calculating upper bounds, namely lagrangian relaxation and stochastic gradient methods. The gradient is approximated by using convolution approximation or integration par part method (see top figure, opposite page). These upper bounds are used within Branch and Bound framework to derive exact integer solutions for instances with up to 150 binary variables (see bottom figure, opposite page).

Sidebar

(continued)



Convolution approximation vs Integration by parts



Lagrangian relaxation and stochastic Gradient Method

Strategic Planning

Original LRI Goals

GraphComb's contributions are in line with the *dynamic networks* challenge. Our team studies small worlds and wireless networks, including GSM, UMTS and Sensorial networks, from theoretical, algorithmic and simulation perspectives.

Self Assessment

The GraphComb team focuses on graph theory and combinatorial and stochastic optimization, with natural collaborations between these two areas. In the former, we study the existence of solutions for graph theory problems whilst in the latter we propose algorithms for solving such problems. We develop regular collaborations with the Algo team, especially for graph coloring problems and counting and enumerating.

Relationship to LRI Strategic Plan

Combinatorial stochastic optimization meets fully uncertainty theme. Four PhD students topics are concerned with different aspects of stochastic programming and risk modeling, namely 0-1 stochastic knapsack problems, probabilistic constraints, stochastic combinatorial bilevel programming, stochastic submodular functions... Moreover, several international ongoing collaborations especially with the University of Trondheim, the University of Duisburg and the University of Hong Kong are dealing with stochastic optimization. Finally, an industrial collaboration between LRI and EDF related to uncertainty and semidefinite programming is on progress.

Honors

Keynote Addresses

- Charles Delorme, invited keynote speaker, International workshop on optimal network topologies, Australia, 2005.
- Charles Delorme, invited keynote speaker, International workshop on optimal network topologies, 2007.
- Evelyne Flandrin, invited keynote speaker, Cycles and Colourings, Slovakia, 2007.
- Odile Favaron, invited keynote speaker, 36th Annual Iranian Mathematics Conference, Tabriz, Iran, 2006. Title: *k-domination and k-independence in graphs*.

Other Honors

- H. Li, Changjiang Scholar Grant of Lanzhou University, China;
- H. Li, Liqing Lecture Professor grant of Shandong University, China;

Evaluation of Research

Editorial Boards

International

- 4OR, *A Quarterly Journal of Operations Research*, Springer: A. Lisser (2002-)
- ACKE, *International Journal of Graphs and Combinatorics*, Kalasalingam Univ.: O. Favaron (2004-), H. Li (2004-)
- DC, *Distributed Computing*, Springer: P. Fraigniaud (2004-)
- TOCS, *Theory of Computing Systems*, Springer: P. Fraigniaud (2004-)
- JOIN, *Journal of Interconnection Networks*, WSPC: P. Fraigniaud (2004-)

National

- JSMS, *Journal of Systems Science and Mathematical Science*, China: H. Li (2004-)

Program Committees

Chair

- GTCA, *International Symposium on Graph Theory and Combinatorial Algorithms*, Beijing: H. Li (2007, PC Chair)
- FAW, *International Frontiers of Algorithmics Workshop*, Lanzhou: H. Li (2007, General Chair)
- DISC *International Symposium on DIStributed Computing*, Cracow: P. Fraigniaud (2005, Program Chair)
- SIROCCO *International Colloquia on Structural Information and Communication Complexity*, Castiglioncello: P. Fraigniaud (2007, Steering Program Chair)
- STACS *Symposium on Theoretical Aspects of Computer Science*: P. Fraigniaud (since 2003, Steering Committee member)
- SPAA *ACM Symposium on Parallel Algorithms and Architectures*: P. Fraigniaud (since 2003, Steering Committee member)

Member (international events)

- NCP, *NonConvex Programming*: A. Lisser (2007)
- MCO, *Modelling, Computation and OPtimization*: A. Lisser (2008)
- ICGT, *International Colloquium on Graph Theory*: E. Flandrin (2005)
- FAW, *International Frontiers of Algorithmics Workshop*, E. Flandrin (2007)
- PODC, *Symposium on Principles of Distributed Computing*, P. Fraigniaud (2007)
- MFCS, *International Symposium on Mathematical Foundation of COmputer Science* , P. Fraigniaud (2007)

- MASS, *International Conference on Mobile ad-hoc and Sensor Systems*, P. Fraigniaud (2006, 2007)
- ICDCN, *International Conference on Distributed Computing and Networking*, P. Fraigniaud (2006)
- SIROCCO *International Colloquia on Structural Information and Communication Complexity*, P. Fraigniaud (2006)

Evaluation Committees and Invited Expertise

International

- National Natural Science Foundation of China (NSFC): Hao Li, invited expert (2005-06)

France

- Agence Nationale de la Recherche, (ANR): Abdel LISSER (2007)

Other evaluation activities

- Reviewer for PhD. dissertation: Abdel Lisser (10);

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Volunteer Professional Service

Other Professional Service

- Steering committee of STACS: Pierre Fraigniaud, member since 2003.
- Steering committee of SPAA: Pierre Fraigniaud, member since 2001.
- Steering committee of DISC: Pierre Fraigniaud, member since 2005.

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Contracts and grants

Contracts and grants (jan 2005 - dec 2008)				
Type	*Name*	*Managing Institution*	*Start / Duration*	*Amount*
FNS	ALPAGE		12.2005 / 42 mo.	70 k€
BQR	BQR GRAPH		06.2005 / 12 mo.	11 k€
	PAIR A PAIR		07.2003 / 36 mo.	46 k€

Collaborations

Cooperation Agreements

- Polonium, PHC, EGIDE, Evelyne Flandrin, Pr. Pawel Wojda, Cracovie, Poland.
- FAST, PHC, EGIDE, Evelyne Flandrin, Pr. Mirka Miller, Newcastle, Australie.
- AURORA, PHC, EGIDE, Abdel Lisser, Pr. Gaivoronski, Trondheim, Norway.
- PROCORE, PHC, EGIDE, Abdel Lisser, Pr. Janny Leung, Hong Kong, China.

Collaborations Leading to Joint Publications

GraphComb collaborates with the following universities:

Europe

- University of Trondheim, Norway (A. Gaivoronski);
- University of Duisburg, Germany (R. Schultz);
- University of Aachen, Germany (L. Volkmann);
- Institico Superior Tecnico, Lisbon, Portugal (R. Cordevil);
- EPFL, Lausanne, Switzerland (D. de Werra);
- ETH, Zurich, Switzerland (R. Zenklusen);
- Hangarian Academy of Sciences, Hungary (E. Gyori);
- University of West Bohemia, Czech Republic (Z. Ryjacek);
- Faculty of Applied Mathematics, Poland (A. Marczyk);
- Aalborg university, Denmark (P. Vertergaard);

South America

- Federal University of Rio de Janeiro, Brazil (N. Maculan);
- Federal University of Fortaleza, Brazil (R. Andrade);
- Federal University of Fortaleza, Brazil (R. Andrade);
- University of Santiago de Chile, Chile (I. Soto);

Asia

- Chinese University of Hong Kong, Hong Kong (J. Leung);
- Chinese Academy of Science, China, (F. Tian);
- Xinjiang University, China (Z. Zhang);
- Lanzhou University, China (H. Zhang, L. Li, X. Li);
- Eastern China Normal University, China (J. Shu);
- Central China Normal University, China (Z. Hu);

Other

- HEC Montreal, Canada (P. Hansen);
- University of KwaZulu-Natal, South-Africa (M. Henning);
- University of Blidia, Algeria (M. Blidia, M. Chellali);
- University of Tabriz, Iran (M. Sheikholeslami, H. Karami);
- University of Zanjan, Iran (M. Zaker);
- Lebanese university I, Lebanon (A. El Sahili).

Other Collaborations

The following GraphComb group members were invited to foreign universities:

- Mekkia Kouider: University of Alger, Algeria, 1 week, 2005 and 2006.
- Hao Li: University of Tcheque Republic, 1 week, 2006; Chinese Academy of Sciences, China, 1 week, 2006; University of Lanzhou, 1 week, 2006; Technische Universitat Wien, 3 weeks, 2007; Lanzhou University, 2 months, 2008.
- Odile Favaron: University of Blida, Algeria 1 week, April 2005; University of Montreal, Gerad, 2 weeks, August 2006.

Training and Education

Defended Habilitations (jan 2005 - sept 2008)			
Name	*First name*	*Date*	*Position*
BERTHOME	Pascal	10.2006	PR, ENSI Bourges

Defended doctorates (jan 2005 - sept 2008)			
Name	*First name*	*Date*	*Position*
BENAJAM	Wadie	11.2005	Engineer, SSII
DANG NGOC	Frédéric	02.2006	
FAIK	Taoufik	05.2005	Engineer, SSII
GASTAL	Lynda	09.2007	Engineer, SSII
GAURON	Philippe	09.2006	
ILCINKAS	David	07.2006	
NISSE	Nicolas	07.2007	
SOGUET	David	07.2008	
WANG	Guanghui	07.2007	Post-doc (France)
ZHOU	Shan	05.2008	

Graduate Courses

- Master Informatique, Université Paris-Sud, *Optimisation de reseaux de telecommunications a tres haut debit* : Abdel Lisser (2001-present).
- Master Informatique, Université Paris-Sud, *Dissemination de l'information* : Pierre Fraigniaud (1999-2006).

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