Doctor-Engineer Didier El Baz, H.D.R.
Senior researcher at LAAS-CNRS, Toulouse France

- **Post-doctoral fellow at MIT, USA, 1984-1985.**
- **Vice-Chairman of the IEEE Technical Committee on Scalable Computing (TCSC) of the IEEE Computer Society (CS) since 2023.**
- **2017-2021: Co-Director of the International Laboratory Information Security of Cyber-Physical Systems", ITMO University, Saint-Petersburg, Federation of Russia.**
- **2015-2023: Lecturer at University of Science and Technology, Beijing China.**

- **More than 150 papers published in renowned journal and conferences:**

SIAM SICON, SIAM SINUM, **MOC**, **IMA J. Num. Anal. EJOR**, **COR**, **COAP,**

2 Mechatronics, Fut. Gen. Comp. Syst., 5 **JPDC**, ETNA, JCAM, EJIE, IJPP.

✓Papers with distinguished **Professors in 9 nine countries including China (25 %)**

Algéria, Australia, China, Germany, Japan, Mexico, Russia, UK, USA.

1. Fields of Interest, Originality

- **Multidisciplinary research dealing with computing**

➢ **Computer Science, optimization and numerical methods.**

❑ **High-Performance Computing (HPC)**

99 published papers ;

➢ Nonlinear Optimization, numerical simulation: from **SIAM SINUM** 1990 (Q1, 60 quotes) to Concurrency Comp. 2020 (Q2).

➢ Combinatorial optimization, scheduling, planning: from **JPDC** 2005 (Q1, 45 quotes) to **COR** 2012 (Q1, 110), **JPDC** 2019 (Q1, 60) and **Journal of Supercomputing** 2022 (Q2).

❑ **Distributed Computing**

23 published papers ;

➢ Distributed routing, distributed pattern recognition: from **SIAM SICON** 1987 (Q1, 129) to **Mechatronics** 2012 (Q1, 32);

➢ Distributed reconfiguration of modular robotic systems: **Mechatronics** 2019 (Q1,11).

↑ Asynchronism ↓

1. Fields of Interest, Originality

- **High-Performance Computing**

➢ **Discretized continuous problems: parallel asynchronous iteratives algorithms**

56 published papers:

Numerical Simulation: from **SIAM SINUM** 1990 (Q1, 60 quotes) to Concurrency Comp. 2020 (Q2).

Convex Optimization: from **SIAM SICON** 1987 (Q1, 129 quotes) to IPDPSW 2015;

➢ **Discrete Problems: exact methods, parallel heuristics**

41 published papers:

Knapsack problems: from **JPDC** 2005 (A/Q1, 45),to **EJOR** 2009 (Q1, 97), **COR** 2012 (Q1, 111) ;

Scheduling: **JPDC** 2018 (A/Q1, 17), **JPDC** 2019 (A/Q1, 60), **Fut. Gen. Comp. Syst.** 2020 (Q1, 33) ;

Planning: The Journal of Supercomputing 2022 (Q2).

2. High-Performance Computing ; Continuous problems, **parallel asynchronous iterative algorithms**

- **Design of a new class of flexible parallel asynchronous iterative algorithms** well suited to one-sided communications like put() and get().

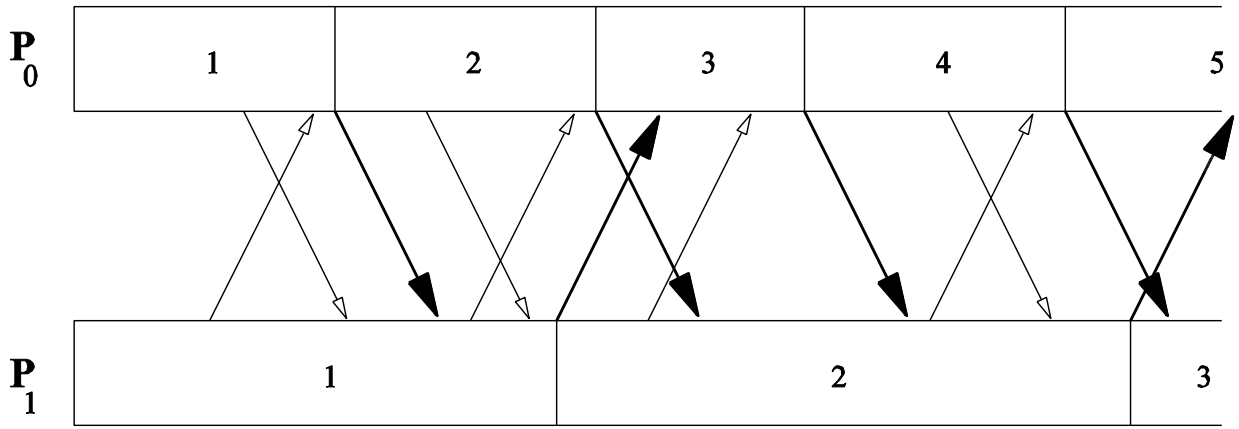


Fig 1. Computations (iterations) and data exchanges between two processors

- Mathematical modelling;
- Convergence study for many applications like numerical simulation and convex optimization;
- Round-off errors;
- Stopping criteria.

2. High-Performance Computing
Parallel Asynchronous Iterative Algorithms

- Implementation on supercomputers:

➢From **Cray T3E ParCo 1997** (B2, 13), to **IBM SP4 JPDC** 2007 (A/Q1, 28 quotes) and **ATOS Sequana Survey in Geophysics** 2023.

57 published papers on parallel asynchronous iterative algorithms

SIAM SICON 1987 (Q1, 129), **SIAM SINUM** 1990 (Q1, 60) , **JPDC** 1996 (A/Q1, 68), **MOC** 1998 (Q1, 85), **JCAM** 2005 (Q2, 42), **JPDC** 2007 (A/Q1, 31), **Concurrency and Computation** 2020 (Q2).

2.1 Achievement: GRIDHPC tool for facilitating deployment and implementation of Parallel Algorithms on Computing Grids

- Holder and Coordinator of French project **ANR-07-CIS7-011**, 2008 – 2011, **500,000 €** ; with laboratories from several universities like IRIT, FEMTO-ST, University of Picardy.

➢ **Achievement: GridHPC tool for Grid Computing**

- Decentralized environnement for Grid Computing;
- loosely synchronous applications;
- Heterogeneous networks, e.g. Ethernet, Infiniband, Myrinet and multicore context,

PDP 2010 (31), IEEE IPDPSW 2010 (34), 7th GENI Eng. Conf., IEEE IPDPSW 2011 (17), **HPCC** 2012 (9), PDP 2013, PDP 2018, **Concurrency Computation** 2020 (Q2).

Joint papers LAAS - IRIT, LAAS – FEMTO-ST, LAAS – University of Picardy.

4 Ph.D. theses defended.

2.2 Effect of parallel asynchronous iterative algorithms

- Parallel asynchronous iterative algorithms are **currently used in many highly reputed international scientific centers like:**

➢**Oak Ridge National Laboratory, USA,** J. Dongarra (Turing price 2021);

➢**Institut Jacques-Louis Lions Paris France,** P. Combettes ;

➢**University of Lyon France,** D. Tromeur-Dervout;

➢**University of Genova Switzerland,** M. Gander.

✓Asynchronous preconditionners based on domain-decomposition;

✓Asynchronous smoothers for multigrid méthods.

2.3 International Recognition

- ***Professor Yousef Saad (h-index : 74),* University of Minnesota, Iterative methods for linear systems of equations: A brief historical journey, *Contemporary Mathematics, 2020*.**

The work by Miellou ***generated an important following in France, with papers that focused on convergence as well as parallel implementations****, see, e.g., [7, 21,* ***20, 9,*** *35, 6,* ***50****]. **Some of the work done in France in those days was truly visionary.** Discussions that I attended as a student in Grenoble could be tense sometimes, with one camp claiming that the methods were utopian.* ***They were*** *not necessarily utopian but* ***certainly ahead of their time by a few decades****. In fact this work has recently staged a strong come back* ***with the advent of very large high-performance computers where communication is expensive****…*

*[**9**] D. P. Bertsekas and **Didier El Baz,** Distributed asynchronous relaxation methods for convex network flow problems, **SIAM Journal on Control and Optimization** 25 (1987), no. 1, 74-85.* (129)

*[**20**] **Didier El Baz**, M-functions and parallel asynchronous algorithms, **SIAM Journal on Numerical Analysis** 27 (1990), N° 1, 136-140.* (59)

*[**50**] J. C. Miellou, **D. El Baz**, and P. Spiteri, A new class of asynchronous iterative algorithms with order intervals,* **Mathematics of Computation** *67 (1998), 237-255.* (84)

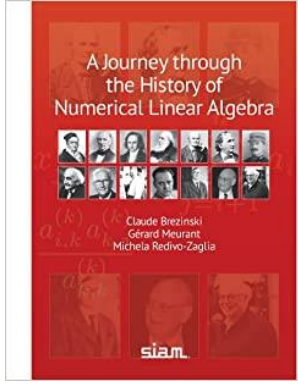
2.3 International Recognition

- ***I. Yamazaki, E. Chow, A. Bouteiller, Jack Dongarra (Prix Turing 2021, h-index 132), Performance of Asynchronous Optimized Schwarz with One-sided Communication, Parallel Computing, 2019.***
- ***The US Department of Energy has identified the effect of synchronization as one of the primary performance-limiting factors on anticipated exascale supercomputers … In [17], a few different ways of using two-sided and one-sided MPI to implement the asynchronous communication for a general iterative algorithm were proposed,***
- ***[17] Didier El Baz**, Communication study and implementation analysis of parallel asynchronous iterative algorithms on message passing architectures, in:* **PDP 2007**.

➢ **One-sided operations of communication with direct memory access like put() and get() of SHMEM library of Cray.**

➢ **Implementation on Cray T3E, experimental tests for network flow problems study of efficiency of parallel asynchronous iterative algorithms → ParCo 1997 (13).**

2.3 International Recognition



- ***Claude Brezinski, Gérard Meurant, Michela Redivo-Zaglia, A Journey through the history of Numerical Linear Algebra, SIAM,*** *Philadelphia, 2023, p. 195 and 196.*
- *"Asynchronous iterative methods were studied in the 1980s and 1990s, mainly for nonlinear fixed-point equations…* ***Three different techniques were used to analyze convergence: contracting operators, partial ordering, and nested subspaces.*** *Let us cite a few papers and a book from the 1980's…* ***Other interesting papers were [1266] by Frommer and Szyld in 2000, [1077] by Didier El Baz, Spiteri, Miellou and Mohamed Jarraya in 2002… A difficult problem in the asynchronous methods we have seen before is how to stop the iterations on parallel computers****. Doing that straightforwardly may reintroduce synchronizations in a purely parallel algorithm or it can lead to an early stop if only local stopping criteria are introduced****. For discussions of this problem see [898] by Edsger Wybe Dijkstra and Leslie Lamport in 1985, … and [2244] by Miellou, Spiteri and El Baz in 2008."***
- *[**1077**] D. El Baz, P. Spiteri, J.C. Miellou, M. Jarraya, Mathematical study of perturbed asynchronous iterations designed for distributed termination, International Mathematical Journal, Vol. 1, N˚5, p. 491-503, 2002.*
- *[**2244**] J.-C. Miellou, P. Spiteri, D. El Baz, A new stopping criterion for linear perturbed asynchro-nous iterations, Journal of Computational and Applied Mathematics, Vol. 219, N° 2, October 1, 2008, p. 471-483.*

2.4 Trends in High-Performance Computing

- **Rise of the concept of parallelism**
  - Multicore processors, Intel Xeon Scalable
  - Computing accelerators: Graphics Processing Units (GPU), Intel Xeon Phi.
- **Rise of network technologies**
  - Convergence of parallel and distributed computing.
  - Grid computing, volunteer, cloud et edge computing.
- **Rise of parallel asynchronous iterative algorithms.**
- **Rise of parallelism in Artificial Intelligence:**
  - Parallel / distributed learning, federated learning,
  - Transformers intensive use of GPUs.

3. Scalable Parallel Algorithms with Computing Accelerators

- **I was pioneer in GPU computing and using computing accelerators like MIC**

➢ **Organiser of first international NVIDIA CUDA tutorial in Europe in 2008 with NVIDIA France and NVIDIA USA**

27 published papers articles on GPU computing: two papers published in Journal of Parallel and Distributed Computing, COR, Fut. Gen. Comp. Syst. 3 Ph.D. theses defendeded, two post-docs.

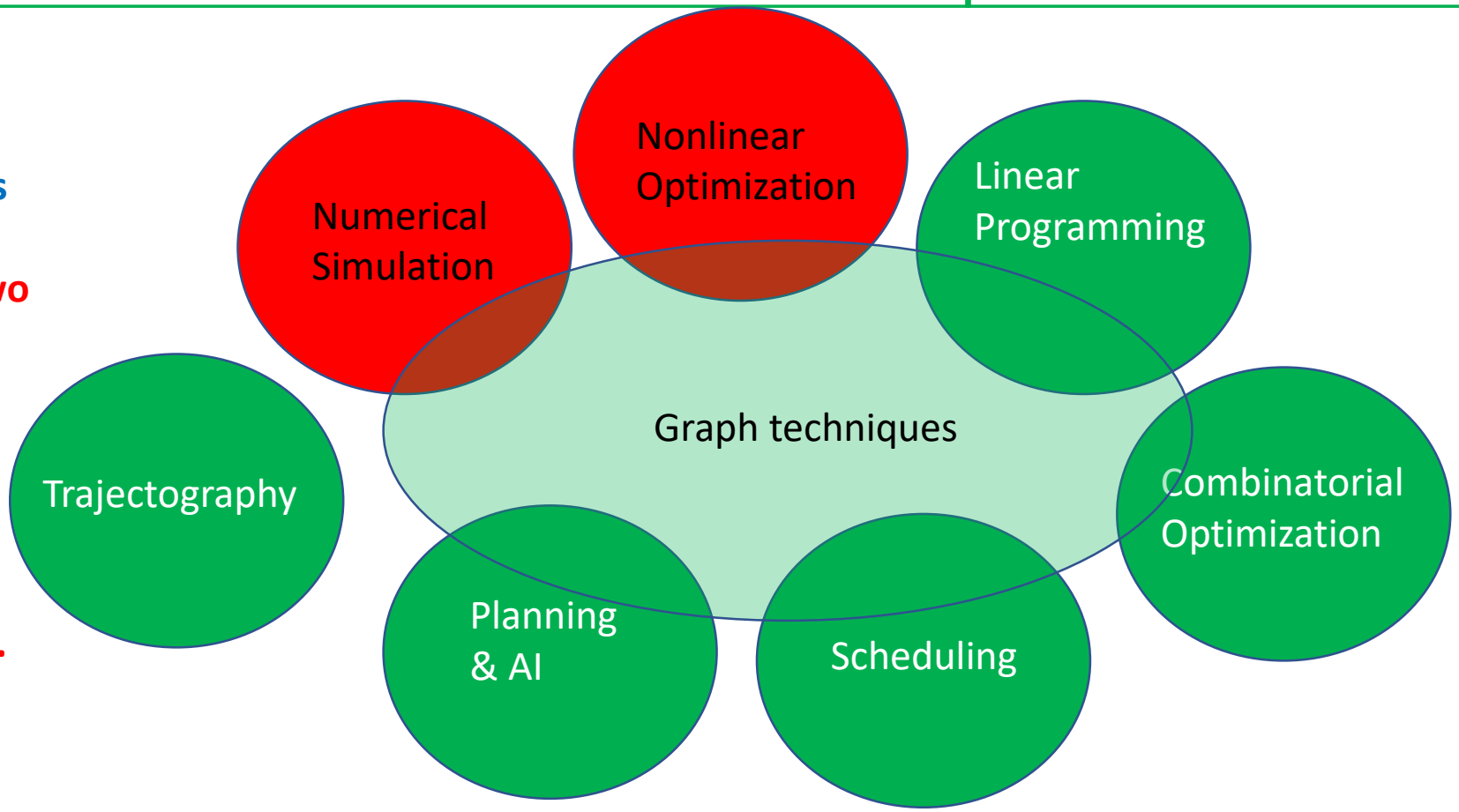


Figure 2. GPU computing

3. Scalable Parallel Algorithms with Computing Accelerators

- **Combinatorial Optimization and GPU computing**

  Knapsack problems:

  - Dynamic Programming, **COR** 2012 (Q1, 110) PDP 2011 (37);
  - Branch and Bound, IPDPSW 2012 (82) , PDP 2012 (46).

- **Scheduling and GPU computing**

  - Job shop, Branch and Bound, **JPDC** 2018 (A/Q1, 18) ; CERIST ALGER.
  - Energy efficient dynamic flexible flow shop scheduling problem Genetic Algorithms, **JPDC** 2019 (A/Q1, 60),
  - Dynamic energy aware job shop scheduling, **Future Generations Computer Systems** 2020 (Q1, 33), Math Prog. Eng. 2019.

  2019: Ph.D. defense of DR. Luo Jia, funding of China Science Council ***(IEEE Outstanding Ph.D. Thesis award 2020 in Scalable Computing).***

3. Scalable Parallel Algorithms with Computing Accelerators

- **Trajectography** problems and GPU or Intel Xeon Phi computing:
  French National Center for Space Studies (CNES)
  Stratospheric balloons drift descent analysis.
  Achievement: Aquilon code in operational, IJPP 2017 (Q2, 15).

  Descent of rockets or satellites, 8th ESA ESASV 2015 (8).
  Achievement: Calima code,
  Defense of Ph.D. Thesis 2017.

3. Scalable Parallel Algorithms with Computing Accelerators

- **Linear Programming**

  Parallel Simplex method and GPU or multi GPU computing

  IPDPSW 2011 (53), **HPCC** 2011 (61).

- **Learning (Artificial Neural Networks)**

  Predicting demand of a brewery with GPU computing IPDPSW 2017 (10).

- **Centrality Algorithms in graphs**

  Security issues in social networks GPU computing

  JoWUA 2019 (Q2), The Journal of Supercomputing 2023.

Laboratory Information Security of Cyber-Physical Systems", ITMO University, Saint-Petersburg, Federation of Russia.

3. Scalable Parallel Algorithms with Computing Accelerators

- **Collaboration with NVIDIA Corporation**

➢ **NVIDIA Corporation Sponsoring**

- IEEE UIC 2016, Toulouse (256 participants).

- Workshop Deep learning, July 18, 2016.
- Workshop CUDA, OpenACC, LAAS-CNRS, March 22, 2016.

➢ **Gift of three GPU devices and computing hours.**

- one K40 GPU (2014), two C2050 GPUs (2012),
- computing hours on K80 GPU (2017).

4. Cyber-Physical Systems and Scalable Distributed Algorithms

Distributed Systems, Distributed Algorithms → Smart Systems

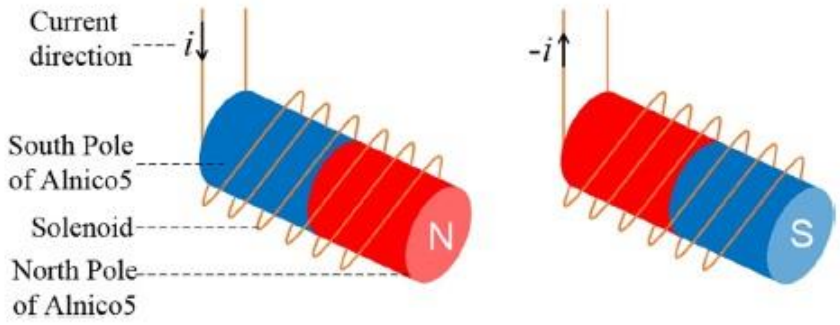
-Project Smart Surface, ANR 06 ROBO 0009, 2007 – 2010;

-Distributed differentiation of parts in a smart surface, **Mechatronics 2012 (Q1, 33).**

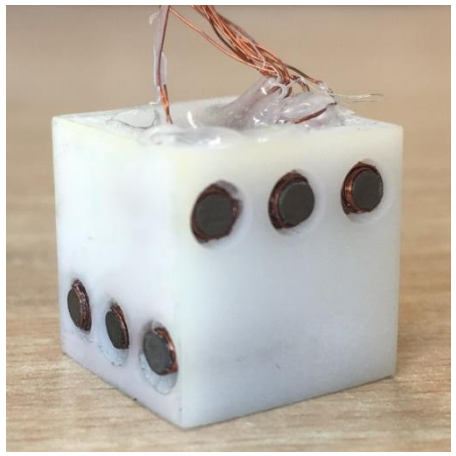
-Project Smart Blocks, ANR-2011 BS03-005 → 2011 – 2015;

-Ph.D. Thesis, codirection with UST Beijing China (thesis defended on February 2018).

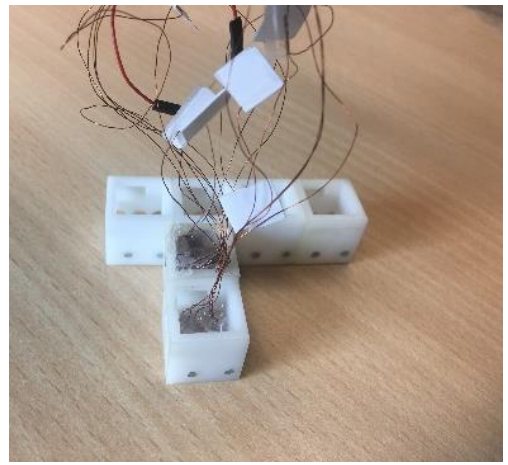
-Actuators : electro-permanent magnets, **Mechatronics 2019 (Q1, 11).**



- Principe of actuators



- DILI module



- Design of actuators ;
- Distributed Algorithms for reconfigurable systems.

5. Internet of Things and High-Performance Computing

- I was pionneer in HPC with IOT Applications
- I was Keynote Speaker at international conferences:

  IIKI 2014 (25) Beijing;

  ParCo 2017 (4) Bologne, Italy.

6. Management of research

- **Founder and Head of team Distributed Computing and Asynchronism (CDA) at LAAS-CNRS**

October 2007 – August 2019.

team:

two Associate Professors, one CNRS researcher, one affiliated researcher;

10 Ph.D. students;

3 Foreign Visiting Scientists,

4 Postdocs.

- **Member of Council of Direction of my laboratory: LAAS-CNRS, 2007 – 2019.**

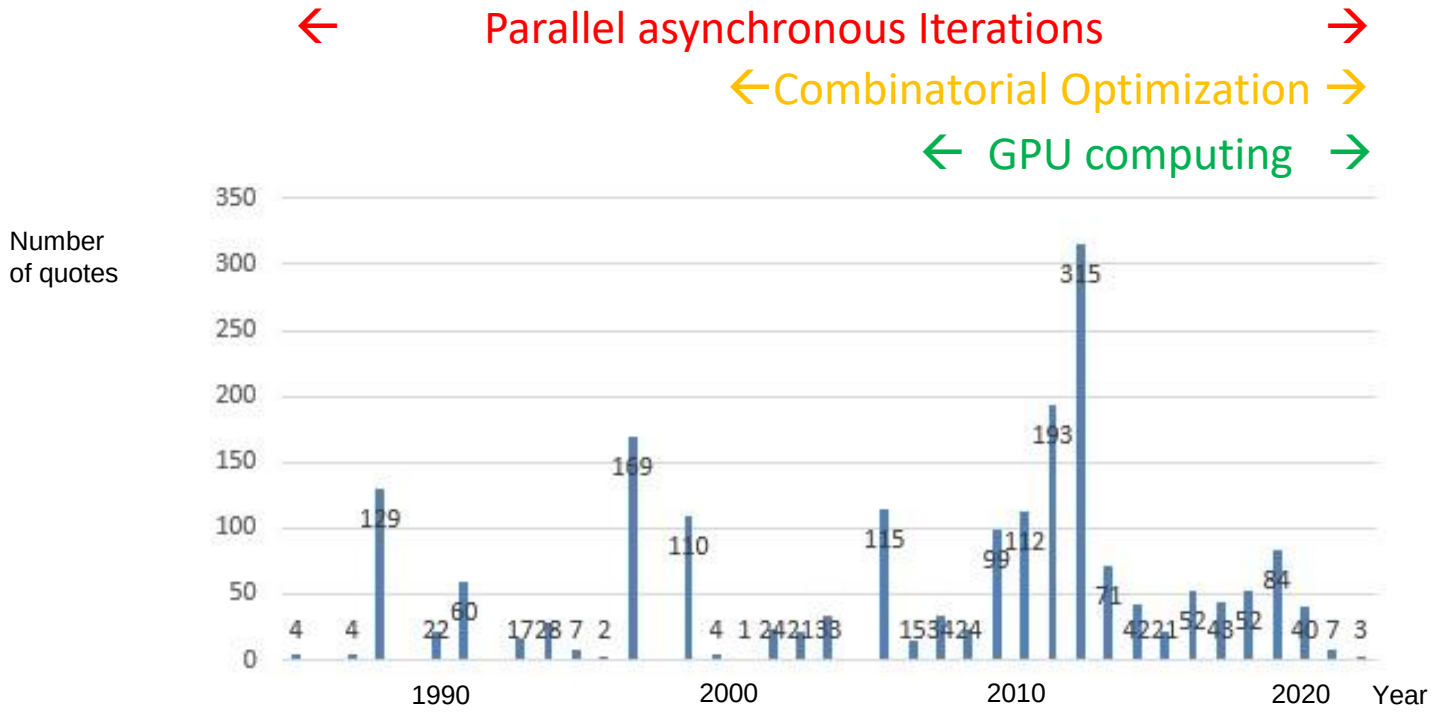
6. Publications

- *More than 150 papers;*
- *h-index Google Scholar: 25*
- *h-index Scopus : 19*
- *i10-index : 52*
- *g-index : 40*
- *709 quotes since 2018 (Google Scholar)*
- *Average number of authors / publication: 2,5*
- *37% of papers with an author of another lab.*

Quotes Google Scholar 2017 - 2024

6. Publications

- Main papers and their quotes in the scientific literature.



Papers published per year and their total quotes

7. International Cooperations

- **Since 2013, Collaboration CNRS with University of Sciences and Technologies Beijing China Lectures on an Introduction to High Performance Computing (32 lectures)**
  Distributed systems, cyber-physical systems

  - one Ph.D. Thesis defended in codirection (2018) → postdoc, **Mechatronics 2019** (Q1, 9)

- **2017-2021, Co-head of International Russian Laboratory on Information Security of Cyber-Physical Systems, Université ITMO, Saint-Petersburg, Russian Federation.**

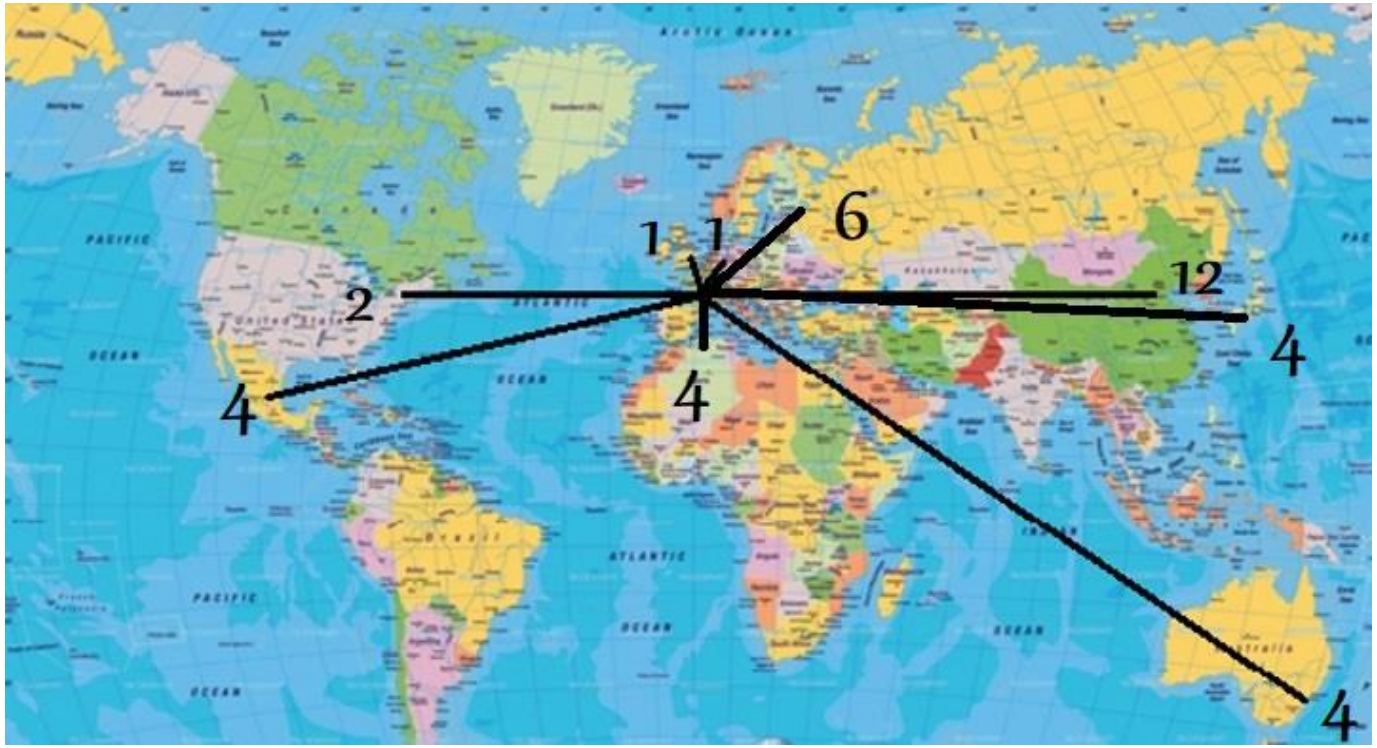
  - Two Ph.D. these defended in 2021, international co-direction (ITMO University Saint-Petersburg-UPS Toulouse).

  IDAACS 2017 (16), **JoWUA 2019** (Q2, 5).

- **2018 Project PHC Tassili with CERIST Algiers and University Houari Boumediène.**

  Big Data and GPU computing, **JoWUA 2019.**

7. International Cooperations



International cooperations and number of papers

National cooperations and number of papers

8. Scientific Influence

- **Didier EL BAZ, Keynote Speaker at international conferences:**

  PARCO 2017, Saint-Petersburg Russia,

  PDP 2017, Bologne Italy,

  IIKI 2014, Beijing China.

- **13 invited speeches 2013-2023 :**

  ITMO Saint-Petersburg Russia 2017, 2018 & 2019 ;

  CNES Toulouse France 2019 ;

  IRAP Toulouse France 2018 ;

  China University of Geo Sciences Beijing 2016 & 2017 China;

  University of Petroleum Qingdao 2015 China;

  CERIST Algiers Algeria 2016 ;

  CNES Paris France 2015 ;

  University of Science & Technologies Beijing China 2014

8.1 Responsabilities in Conference Organization

Program Chair	**5**	**19th IEEE UIC 2022, Haikou China ; 13th IDC 2019, Saint-Petersburg Russia; 17th IEEE CSE 2014, Chengdu China; PDP 2009, Weimar Germany; PDP 2008, Toulouse France.**
General Chair	**9**	**17th IEEE Scalcom 2017, San Francisco USA; 13th IEEE UIC 2016, 16th IEEE Scalcom 2016, 13th IEEE ATC 2016, Toulouse France (250 participants) 18th IEEE CSE 2015 Porto IEEE, iThings 2013 Beijing China**
Organizing Com. Chair	**2**	**IEEE UIC 2016, Toulouse France(250 attendees) PDP 2008 Toulouse (140 attendeees),**
Steering Committee	**3**	**IEEE ScalCom, IEEE Smart World, IEEE iThings**
IEEE Tech. Com. Chair	**1**	**Scalable Computing, IEEE CS Society**
Award Committee	**1**	**Excellence Committee in Scalable Computing**
Workshops Chair	**2**	**HPCC 2014 Paris, IEEE iThings 2012 Besançon**
Workshop Chair	**22**	**IEEE PDCO 2011–2023 at IPDPS, GPU computing PDP**

8.2 Lectures given at Universities

- Topic: High-Performance Computing, distributed systems lectures

➢University of Antilles, Pointe à Pitre France 2023 (20 hours)

➢University of Science and Technology, Beijing, 2015 – 2023 (32 hours)

➢Sichuan University, Chengdu, 2016 (32 hours);

➢University of Geo Sciences, Beijing, 2017 (32 hours);

➢University Houari Boumédiène, Algiers Algeria, 2016.

➢Reviewer for 43 different scientific journals.

➢Fourteen Theses or HDR reports including one in Italy and one in Luxembourg.

➢Additional participation to nine Juries (2007-2023).

➢Evaluation of international projects 2020: Conacyt, Mexico; 2023: American University in Beirut, Lebanon.

9. Current and Previous Collaborations with Chinese Professors

- *Professor Ning Huansheng, University of Science and Technology Beijing,*
- *Professor Yang Laurence T., School of Computer Science and Technology, Wuhan National Laboratory for Optoelectronics, Huazhong University of Science and Technology, Wuhan, Wuhan,*
- *Professor Wang Lei, School of Software, Dalian University of Technology, Dalian,*
- *Professor Chen Zhikui, School of Software, Dalian University of Technology, Dalian,*
- *Professor Peng Jian, Sichuan University, Chengdu,*
- *Professor Yunchuan Sun, Normal University Beijing,*
- *Professor Hao Moa , Communication University of China,*
- *Professor Shi Lei, Communication University of China*
- *Professor Liu Xingang, University of Electronic Science and Technology of China, Chengdu,*
- *Professor Zhou Zhangbing, China University of Geosciences Beijing,*
- *Professor Luo Jia, Beijing University of Technology, Beijing,*
- *Professor, Rui, Beijing University of Technology, Beijing.*
- *Dr. Zhu Li, Xi'an,*