

# **Dr. Sauro Succi: Curriculum Vitae**

# 1 Biographical data

- **1954**; Born in Forli (Italy)
- **1982**; Married to Claudia Gentile
- **1993**; Daughter Caterina

## Address

Professional.: IAC/CNR, Via dei Taurini 9, 00185, Roma  
phone :+39 6 4933 7454, fax: +39 6 4993 7440  
e-mail: [succi@iac.rm.cnr.it](mailto:succi@iac.rm.cnr.it),  
[succi@physics.harvard.edu](mailto:succi@physics.harvard.edu)  
<http://www.iac.rm.cnr.it/~succi>

Private: Via del Pianeta Terra, 66, 00144, Roma,  
phone: +39 06 5290 016

## 2 Education

- **1987:** Ph.D. degree in Plasma Physics  
Ecole Polytechnique Federale de Lausanne (Suisse)  
Dissertation: "*Quasilinear Modelling of Lower Hybrid Current Drive and Related Problems*",
- **1980-1981:** Post-graduate school  
"Advanced Methods in Neutronics", University of Bologna, (full notes).
- **1979-80:** Military duties: Aeronautics
- **1979:** Laurea in Nuclear Engineering  
University of Bologna, Faculty of Engineering  
Thesis: "*Non-isotropy effects in the forced diffusion of charged particles in diffusive and multiplicative media*" (cum laude)
- **1973:** Scientific high-school degree  
Liceo Scientifico, F. P. De Calboli, Forli (60/60).

### 3 Professional Record

**Keywords:** *Mathematical Modeling, Numerical Simulation, Computational and Statistical Physics, Fluid Dynamics and Condensed Matter, Dynamics of Complex Systems*

CURRENT POSITION:

**Director of Research, Istituto Applicazioni del Calcolo (IAC), CNR, Rome**

BASIC CURSUS:

- **1995-: Director of Research, Istituto Applicazioni del Calcolo, Rome**

*Employer:* National Research Council, Rome, Italy

*Position:* Director of Research (Dirigente di Ricerca) in Differential Modeling and Numerical Analysis (**permanent**).

*Activity:* Scientific and financial responsibility for the research line ('Commissa'): Complex Systems in Fluid-Dynamics and Biology.

Adviser to the Director on the general management of the Institute.

- **1995: Group leader, High Performance Computing Division, ENEA, Rome**

*Employer:* Ente Nazionale Energie Alternative (ENEA)

*Position:* Group leader, High Performance Computing Division

*Activity:* Not undertaken, on account of the position above.

- **1986-95: Industry sector coordinator, IBM European Center for Scientific and Engineering Computing, Rome**

*Employer:* International Business Machines Corporation

*Position:* Industry sector coordinator, senior researcher, researcher Computational Physics/Engineering group at the IBM European Center for Scientific and Engineering Computing (ECSEC)

*Activity:* Development of computational models and algorithms for physics and engineering applications on parallel computers. Consulting to the operations of the Scientific and Technical Computing Business Unit of IBM Europe. Scientific-technical coordination of joint projects with IBM european academic and industrial partners in the field of computational physics/engineering.

- **1982-1986: PhD appointment, Ecole Polytechnique Federale Lausanne**

*Employer:* Centre de Recherches en Physique des Plasmas, Ecole Polytechnique Federale Lausanne (EPFL), Switzerland.

*Position:* Ph.D. student

*Activity:* Day-by-day use of magnetohydrodynamic stability codes for computing the stability limits of the JET (Joint European Torus) tokamak and development of mathematical and computer models for plasma heating via magnetohydrodynamic and RF waves.

- **1981-82: Fellowship holder, Max Planck Institut fuer Plasma-physik, Garching (Germany)**

*Employer:* EURATOM, Brussels

*Position:* European Fellowship holder

*Activity:* Analysis and development of mathematical models and numerical Monte Carlo algorithms for thermonuclear plasma heating via neutral beam injection.

- **1980-81: Fellowship holder, Ente Nazionale Energie Alternative**

*Employer:* Dipartimento Reattori Veloci, Ente Energie Alternative (ENEA) Bologna

*Position:* Fellowship holder

*Activity:* Analysis and development of mathematical models and numerical algorithms for the optimal control of fast breeder reactors.

## 4 Other Appointments

- **2015** Michael Visiting Professor, *Weizmann Institute*, Rehovot, Israel
- **2014** Visiting Professor of Computational Science, *Harvard University*
- **2000-**: Research Associate, Lyman Lab. of Physics, *Harvard University*
- **2013-**: Member of the Scientific Review Group for Physical and Engineering Sciences, (SRG-PEN), European Science Foundation, Strasbourg, France.
- **2009-10**: Guest Professor, ETH, Zuerich
- **2010**: Visiting Professor, Mathematics Department, Yale University
- **2010-12**: CNR representative within the Core Group of PESC (Physical Engineering Scientific Committee) of the European Science Foundation, Strasbourg, France.

- **2009-13:** Fellow of the Freiburg Institute for Advanced Studies (FRIAS), Freiburg, Germany
- **2008-10:** CNR representative in the Physics and Engineering Standing Committee of the European Science Foundation
- **2008-9:** Visiting Scholar, Initiative for Innovative Computing, *Harvard University*
- **2005-8:** Visiting Senior Scientist, Mathematics Department, *Tufts University* (Boston)
- **2003:** Senior Visiting Fellow, NASA Ames Ctr for Turbulence Research, *Stanford University*
- **2002-5:** EPSRC (Engineering Physical Science Research Council) Visiting Fellow at the Queen Mary College, *London University*
- **2001-2:** Research Affiliate, Cell Biology Department, *Harvard Medical School*
- **2001-2:** Member of the Scientific Committee of the Center for Advanced Research and Development in Sardinia (CRS4)
- **2000-1:** Appointed by the Italian Ministry of Research and Research as an official referee in the area of Non-Linear and Statistical Mechanics.
- **1999-2001:** Visiting Professor at the Mathematics Department of *Yale University*,
- **1999:** Appointed by the Italian Ministry of University and Research as the National Delegate for the COST-P3 action: *Simulation of Physical Phenomena in Technological Applications*.
- **1995:** Visiting Professor, Computer Science and Physics Dept., *University of Chicago*
- **1994:** Visiting Professor, Mechanics Dept., *University of Paris VI*

## 5 Awards/Honors/Distinctions

Dr Succi belongs to the list of the Top Italian Scientists,  
([http://www.topitalianscientists.org/Top\\_italian\\_scientists\\_VIA-Academy.aspx](http://www.topitalianscientists.org/Top_italian_scientists_VIA-Academy.aspx)).

**2017:** *Aneesur Rahman Prize in Computational Physics, American Physical Society*

- 2017:** Opening Lecture, Meeting of the Israeli Society of Computational Mechanics, Haifa
- 2016:** Editorial Board of Physical Review E: Computational Physics
- 2016:** Third Graeme Bird Lecture, 30th Int. Symp. on Rarefied Gas Dynamics, Univ. of Alberta, BC, Canada
- 2016:** Plenary talk, 31th Symposium on Naval Hydrodynamics, Monterey, USA (declined)
- 2016:** Keynote lecture, 16th Int. Conf. on Computational Science, San Diego, USA
- 2016:** The paper "Lattice Boltzmann 2038" has been selected for inclusion in the EPL Highlights 2016.
- 2015:** *Elected Member of the Academia Europaea* ([www.ae-info.org](http://www.ae-info.org))
- 2015:** The paper "Extended self-similarity in turbulent flows", R. Benzi, S. Ciliberto, R. Tripicciono, C. Baudet, F. Massaioli, and S. Succi, Phys. Rev. E 48, R29 (1993), featured as a PRE milestone paper on occasion of PRE 50,000th publication, PRE Oct. 2015.
- 2015:** Outstanding reviewer of Physica A: Statistical Mechanics and Applications
- 2015:** Plenary talk, Int. Conf. on Computer Simulations in Physics and Beyond, Moscow
- 2014:** P.L. Bhatnagar Memorial Lecture, 59th ISTAM Conference, Bangaluru, India (declined for contingent reasons)
- 2014:** Plenary talk, 10th Europ. Conf. on Fluid Mechanics, Copenhagen
- 2014:** Plenary talk, 26th IUPAP Int. Conf. on Computational Physics, Boston
- 2014:** Keynote lecture, Techfest IIT Bombay
- 2013:** Outstanding Referee of the Physical Review and Physical Review Letters
- 2013:** Senior Fellow of the Erwin Schroedinger Institute, Vienna
- 2012:** Alexander von Humboldt Award renewal
- 2012:** Inclusion in the list of the Top Italian Scientists
- 2011:** Honorable mention to the Gordon Bell Supercomputing Contest, Seattle, November 2011
- 2010:** Co-finalist of the Gordon Bell Supercomputing Contest, New Orleans, November 2010

- 2009:** Fellow of the Freiburg Institute of Advanced Studies, Freiburg, Germany;
- 2008:** The paper "Lattice Gas Dynamics with Enhanced Collisions", F. Higuera, S. Succi, R. Benzi, *Europhys. Lett.* 9, 345, 1989, has been included in the selection of the 40 most cited papers in *Europhys. Lett.* since its inception (1986);
- 2007:** Best Workshop Paper Award, 7th Int. Conf. on Computational Science, Beijing, May 2007, M. Fyta, S. Melchionna, E. Kaxiras, S. Succi, "Multi-scale modeling of biopolymer translocation through a nanopore", *Lecture Notes in Computational Science*, 4487, 786 (2007).
- 2006:** Distinguished Annual Lecture, Leicester University, UK;
- 2005:** *Killam Award, Calgary University, Canada;*
- 2002:** *Alexander von Humboldt Award in Physics, Germany;*
- 1998:** Fellow of the American Physical Society, (Computational Physics)
- 1995:** Windows-on-Science grantee, Hanscom, USA;
- 1986-95:** Three IBM certificates for outstanding scientific publications;
- **2008:** Leonardo Melandri Prize, for distinguished citizens of the Forli-Cesena province, who made outstanding contributions to progress in economy, culture and science
  - **1997:** Golden Medal award of the Pro-Forli Cultural Committee, as a distinguished non-resident citizen.

## 6 Publications

Over 350 publications in international scientific journals and nearly 100 articles in refereed Proceedings, for a total of nearly 19,000 Google Scholar cites ( $h = 58$ ) and nearly 9,000 ISI cites ( $h = 47$ ), as of June 2016. For details see "Publication List" (also available on my [www homepage](#)).  
Dr Succi is included in the list of the Top Italian Scientists.

([http://www.topitalianscientists.org/Top\\_italian\\_scientists\\_VIA-Academy.aspx](http://www.topitalianscientists.org/Top_italian_scientists_VIA-Academy.aspx)).



## 7 Books

- **Automati Cellulari: una nuova frontiera del calcolo scientifico**, Serie Informatica Domani, Franco Angeli, (Milan), vol 5, 153 p., 1991.
- **An Introduction to Parallel Computational Fluid Dynamics**, Nova Science, (New York), 233 p., 1996.
- **The Lattice Boltzmann Equation for fluid dynamics and beyond**, Oxford Science Publications: Numerical Mathematics and Scientific Computation, Oxford University Press, 288 p., 2001. The book was positively reviewed in *Europ. J. of Mech. B: Fluids, Computers in Science and Engineering, Physics Today*. The book has been reprinted three times (2002-2004-2006) and has received 3300 Google Scholar cites, as of Jan Dec 2014 In 2014 Soenke Adlung, Senior Editor of Oxford University Press, praised the book as an " *oustanding success, which has established itself as a landmark publication in the field*"
- **Lattice Boltzmann Methods for complex fluid flows**, Lecture notes from the course "An Introduction to lattice Boltzmann methods for complex flow simulations", Rome, Italy, March 3-8, 2008, S. Ubertini, G. Bella, S. Succi, S. Orszag editors, Science4 Press, 2009

### 7.1 Edited Lecture Notes

- **An introduction to computational physics I: Grid methods**. Collana "Appunti", Scuola Normale Superiore di Pisa, 102 p., 2002.
- **An introduction to computational physics II: Particle methods**. Collana "Appunti", Scuola Normale Superiore di Pisa, 100 p., 2003.
- **Numerical methods for atomic quantum gases**, (coauthor). Collana "Appunti", Scuola Normale Superiore di Pisa, 177 p., 2004.

## 8 Scientific Management

Dr Succi is currently responsible of the research line (commessa) *Dynamics of Complex Systems in Fluid Dynamics and Biology*, (Dinamica dei Sistemi Complessi Fluidodinamici e Biologici) within the Italian National Research Council. His major scientific management activities are listed below:

- *Class manager* of the new employees of Direzione Ricerca Scientifica e Tecnologica IBM Italia, Roma, October 89-February 90.
- *Project-leader* of joint projects with academic and industrial partners of IBM Europe in the field of computational physics/engineering. Among others:

- *Air-Liquide*, Paris, (Material processing)
  - *Daimler-Benz*, Stuttgart, (Parallel Fluid-dynamics)
  - *Diesel Ricerche*, Trieste, (Combustion)
  - *Exa Corporation*, Boston, (Digital Combustion)
  - *Meteofrance*, Toulouse, (Parallel Meteorology)
  - *Renault*, Lyon, (Combustion, Engine Design)
  - *Shell Research*, Amsterdam, (Parallel Fluid-dynamics)
  - *Piaggio*, Pisa, (Engine Design)
- *Further industrial contacts:*
    - *Boeing-Corporation*, Seattle, (Parallel Aerodynamics)
    - *Brown-Boveri*, Zurich, (Parallel Fluid-Dynamics)
    - *ELF-Research*, Lyon, (Combustion)
    - *Ford Motors*, Detroit, (Parallel Fluid-Dynamics)
    - *General Motors*, Detroit, (Parallel Fluid-Dynamics)
    - *Rhone-Poulenc*, Paris, (Combustion)
    - *Fiat*, Pomigliano d’Arco, (Lattice Fluid Dynamics)
    - *EXA Corp.*, Lexington, Mass., USA, (Digital Physics).
- *Research contracts and grant proposals*
    - IAC Principal Investigator, ERC Project *Nanojets* (nanofluidics), European Community Starting Grant 306357 (2013-18)
    - Team leader *Parallel porting of the multiscale code MUPHY to the Blue Gene parallel machine*, Harvard University, 2006
    - Consultant: *Collaborative Research: Experimental and Numerical Characterization of Thin Films in Three-Dimensional Porous Media*, National Science Foundation (Hydrologic Sciences unit), 2006
    - Principal Investigator: *INFLUS* (microfluidics), European Community STREP Project NMP-031980, 2006-9 (560 Keur). In partnership with eleven European Institutions from Academia and Industry. This task involved management duties and financial responsibility towards the European Community.
    - IAC Team leader: *Re-engineering of Automotive Vehicles*, Italian Ministry of University and Research, 2006. In partnership with Rome University, FIAT Elasis and CRF Fiat.
    - Coordinator of the Research Contract, *“Modellistica di flussi turbolenti con metodi di cinetica su reticolo Lattice Boltzmann”*, ETA srl-IAC, 2005-6.

- Principal investigator: *Mathematical modelling of microreactors*, Research contract with Unilever (UK) and Numidia (ITA), 2003.
  - Principal investigator: *Metodi numerici e modelli per la simulazione di flussi complessi di interesse industriale (Numerical methods for complex flows of industrial interest, (CNRC00BCBF-001)*, Istituto Applicazioni Calcolo, Univ. of Roma I, La Sapienza, University of Roma II, Tor Vergata. National Research Council Grant "Agenzia 2000", 2001.
  - Project leader: *Mathematical modeling of the collective dynamics of multi-cellular biochemical systems*, Armenise-Harvard Foundation Research Grant, Cell Biology Dept., Harvard Medical School, Istituto Applicazioni Calcolo), 2001.
  - Project coordinator of the NATO grant proposal "*Multiscale modelling of damaging effects from reactive microflows in disordered media*", IAC Rome, Harvard University, Russian Acad. Sciences, Krasnoyarsk, 1998, (PST.CLG.976357), 2000.
  - Investigator within the grant proposal "*Kinetic theory method for Large Eddy Simulation of Turbulence*", DMS-9974289, National Science Foundation (USA), Math. Dept. Yale, IAC, 1999.
  - Investigator within the European network on "*Bridging the space and time scales: a computational approach*", European Science Foundation, 1999-2003.
  - Coordinator of the Research Contract "*Analisi del campo di moto dell'aria all'interno del vano motore di un autoveicolo*", Univ. Roma I,II-IAC-FIAT, 1998-2000.
  - Principal investigator for the joint project "*Microscopic simulation of heterogeneous catalysis*", with Center for Non-Linear Physics, Université Libre Brussels, Belgium-Italy scientific cooperation agreement, 1997-8.
  - Scientific consultant within the contract-study "*Turbulence and Combustion Modeling on Massively Parallel Machines*", ENEA- University of Rome, January 1996-98.
- *Adviser to scientific policy-making international organizations*
    - CNR representative in the Core Group of PESC (Physics and Engineering Standing Committee), of the European Science Foundation, 2008-2012.
    - Member of the Scientific Review Group on Physical and Engineering Sciences (SRG-PEN), European Science Foundation, 2013-.

## 9 Invited talks

Most of the papers listed under "Conference Proceedings" resulted from invited talks, including a number of keynotes. Besides, I delivered many seminars, keynote talks and technical presentations in most european countries, USA, Israel, Japan, India, China and Taiwan. Among others:

- **Academia**

- Plenary talk, "Computer Simulation in Physics and Beyond", Moscow, Sept. (2015)
- COST School on Lattice Boltzmann Methods, Madrid, (2015)
- CECAM workshop on Multiscale Modeling, Madrid, (2015)
- University of Texas at San Antonio, Texas (2015)
- South Western Research Institute, San Antonio, Texas (2015)
- Mathematics Colloquium, Tufts University (2014)
- Physical-Chemistry Seminar Series, Chemistry Dept., Boston Univ. (2014)
- Plenary Talk, IUPAP Conference in Computational Physics, Boston (2014)
- Plenary Talk, European Fluid Mechanics Conference, Copenhagen (2014)
- Special Cosmology Seminar, Physics Dept., *Princeton University*(2014)
- Hans Herrmann's Festschrift, *ETH*, Zuerich, Switzerland (2014)
- Keynote Lecture, Techfest 2014, *Indian Institute of Technology*, Bombay, India,
- Wide Applied Mathematics Seminar, *Harvard University*, (2013)
- Invited Colloquium, *Brookhaven National Lab, USA*, (2013)
- Raman Lecture, *Indian Academy of Sciences*, Bangalore, India, (2013)
- Special Lecture, *J. Nehru Center for Advanced Scientific Research*, Bangalore, India, (2012)
- Nobel Symposium 151: Water in Biology and Medicine, Stockholm, Sweden (later canceled)
- Royal Society of London, London, UK, (2001)
- Physics Dept., *Oxford Univ.*, Oxford, UK (1998)
- BP Institute, *Cambridge Univ.*, Cambridge, UK (2006)
- Chemistry Dept., *Cambridge Univ.*, Cambridge, UK (2006)
- Center for Computational Chemistry Dept., *Cambridge Univ.*, Cambridge, UK (2007)
- Freiburg Institute for Advanced Studies, Freiburg, Germany (2008-13)

- Physics Dept., *Univ. Libre Brussels*, Brussels, Belgium (2007)
- Mechanics Dept., *Paris VI Univ.*, Paris, France (1995)
- Physics Dept., *Scuola Normale Superiore*, Pisa, Italy
- Center for Computational Science, *Amsterdam*, Amsterdam, Holland (1996)
- Fluid Mechanics Dept., *EPFL Lausanne*, Lausanne, Switzerland (1996)
- Computer Science Dept., *Geneva University*, Geneva, Switzerland (1995)
- Material Science Dept. *ETHZ*, Zuerich, Switzerland (1998)
- Center for Computational Science, *Queen Mary Univ.*, London, UK (1999)
- Israel Institute of Technology, *Technion Univ.*, Haifa, Israel (2008)
- Center for Computational Science, *Boston Univ.*, Boston, USA (2002)
- Mathematics Department *Tufts Univ.*, Boston, USA (2006)
- Physics Dept., *Chicago Univ.*, Chicago, USA (1995)
- Mathematics Dept., *Princeton Univ.*, Princeton, USA (1998)
- Chemical Eng. Dept., *Princeton Univ.*, Princeton, USA (2012)
- Fluid Dynamics Research Ctr., *Princeton Univ.*, Princeton, USA (2000)
- Physics Dept., *Columbia Univ.*, New York, USA (2001)
- Physics Dept., *Harvard Univ.*, Cambridge, USA (2005)
- Mathematics Dept., *Yale Univ.*, New Haven, USA (2010)
- Mechanical Engineering Dept., *Calgary Univ.*, Calgary, Canada (2006)
- Nanotechnology Center, *Technion Univ.*, Haifa, Israel (2008)
- Mechanics Dept, *Beijing Univ.*, Beijing, China (1997)
- Applied Energy Institute, Tokyo, Japan. (1992)
- Aeronautic Engineering Dept., University of Kyoto, Japan. (2004)
- Physics Department, Academia Sinica, Taiwan (2004)

- **Industry**

- *Nvidia Research Center*, Pune, India
- *Boeing Corporation*, Seattle, USA
- *Fiat Elasis*, Pomigliano, Italy
- *Ford Motors*, Detroit, USA
- *Fuji Research*, Tokyo, Japan
- *EXA Corporation*, Boston, USA

- *General Motors*, Detroit, USA
- *IBM Research*, San Jose, USA
- *Schlumbersee Research*, Cambridge, UK
- *Shell Research*, Amsterdam, Holland
- *Enitecnologie*, Milan, Italy

- **Keynote and plenary lectures**

- Future directions in lattice Boltzmann Fluid Dynamics, *European Fluid Mech. Conference, Copenhagen, Sept, 2014*
- Future directions in lattice Boltzmann Computing, *Computational Physics Conference, Boston, Aug., 2014*
- Mesoscopic models of soft-glassy flows, *Heraus Symposium, Bonn, Sept. 2014*
- A crash course in Lattice Boltzmann: in his own city! *Erwin Schroedinger Institute Vienna, May, 2013*
- Remembering Steve: Flows, codes and computers, *Orszag memorial, Yale Univ., Feb. 2013*
- An Introduction to the Lattice Boltzmann method, *Wide Applied Math Seminar, Harvard University, Nov. 2012*
- The Legacy of P.L. Bhatnagar in statistical physics, *Raman Lecture, Indian Academy of Sciences, Bangalore, Feb. 2012*
- Relativistic lattice Boltzmann for quark-gluon plasma simulations, Colloquium Brookhaven National Lab, Jan 2012 (invited, but not delivered)
- Lattice Kinetic theory across scales: from turbulence to electron flows in graphene, *Special Lecture, J. Nehru Ctr for Advanced Scientific Research, Bangalore, India, October 2011.*
- Keynote talk on Lattice Boltzmann modeling of complex flows, *MULTIFLOW 2010, Brussels, November 2010*
- Mesoscopic models of soft-flowing materials, *Novel Simulation Approaches to Soft matter Systems, Dresden, September 2010*
- Lattice Boltzmann across scales: from turbulence to DNA translocation *Int. Workshop on the numerical treatment of soil erosion, Baeza, Spain, September 2010*
- Lattice Boltzmann modeling for quantum fluids, *Center for Computational Science, Manno, Switzerland, December 2009*
- Mesoscopic modeling of soft flowing systems *Black Forest Focus on Soft Matter, Freiburg, Germany, July 2009*
- Multiscale Lattice Boltzmann Molecular Dynamics Simulations: translocation of biopolymers through nanopores, *Freiburg Institute for Advanced Studies, Freiburg, November 2008.*

- Multiscale simulation of nano-biological flows, *Lorentz Center workshop on Physics of Micro and Nano-fluids*, Leiden, June 2008.
- Multiscale Lattice Boltzmann Molecular Dynamics simulations of biopolymers on the Blue-Genie supercomputer, *5th ICMES Conference*, Amsterdam, June 2008.
- Hydrokinetic approach to microfluidics, *SimBioMa Conference, Konstanz, April 2008*
- Boltzmann approach to fluid turbulence, *Solvay Workshop: a tribute to Professor Radu Balescu, Brussels, March 2008*
- Lattice Boltzmann across scales: from turbulence to DNA translocation, *23rd STATPHYS Conference*, Genova, July 2007.
- Multiscale Lattice Boltzmann Molecular Dynamics modeling, of biopolymer translocation across nanopores, *Computations in Nanotechnology*, Technion University, Haifa, Israel, May 2007.
- Lattice Boltzmann across scales: from turbulence to DNA translocation, *Leicester Distinguished Lecture*, Univ. of Leicester, UK, November, 2006
- New Frontiers of Boltzmann Kinetic Theory: from turbulence to DNA translocation, *Killam Award Lecture*, Univ. of Calgary, Canada, September 2006
- Lattice Boltzmann Computing, *3rd Int. Conf. on Fluid Mechanics and Fluid Power*, Bombay, December 2006.
- Plenty of space in the middle: prospects of computational kinetic theory in nanoscience applications, *Synergy between Experiment and Computation in Nanoscale Science*, Harvard, May 2006
- Lattice kinetic methods for mesoscale dynamics, *MESODYN Workshop*, Juelich, April 2006
- Lattice Boltzmann Computing for Multiscale Applications, *2nd ETHZ Workshop on Multiscale Modeling*, Zuerich, October 2005
- Lattice Boltzmann for Computational Fluid Dynamics, *V Symposium on Computational Heat and Mass Transfer*, Paris, May 2005.
- Recent Advances in Lattice Boltzmann Computing, *6th Asian Conference in Computational Fluid Mechanics*, Taiwan, August 2005.
- Lattice Boltzmann for Computational Fluid Dynamics, *Third MIT Conference on Computational Fluid and Solid Mechanics*, Boston, June 2005.
- Lattice Boltzmann methods for reactive flows, *Chemistry Department*, Cambridge University, UK, April 2004
- Recent Advances in lattice Boltzmann computing, *First Reality-Grid Workshop*, Royal Society, London, June 2004.

- A Boltzmann approach to Fluid Turbulence, *International Workshop on Numerical and Asymptotic Methods for Kinetic Equations*, Saarland, (Germany), April 2004.
- Mesoscopic particle methods for complex flows, *ICCS Symposium on Computational Science*, St Petersburg, (Russia), June 2003.
- Accelerated lattice Boltzmann method for steady-state flows, *11th International Conference on Fluid Dynamics and Soft Condensed Matter*, Shanghai, August 2002.
- Lattice Boltzmann methods for reactive micro-flows, *SIMU Conference on Computational Physics*, Konstanz, September 2001.
- Multiphysics applications of the Lattice Boltzmann method, *Europhysics Conference on Computational Physics, CCP01* Aachen, September 2000.
- An introduction to the lattice Boltzmann method, *China-Europe-USA Fluid Mechanics Symposium*, Beijing, August 1999,
- Elimination of fast variables via fictitious lattice dynamics, *Summer-school on "Computer simulations of rare events and the dynamics of classical and quantum condensed phase systems"*, Lerici, July 1997.
- Application of Lattice Boltzmann Methods to Fluid Dynamics, *AGARD Conference 578, Progress and Challenges in CFD Methods and Algorithms*, Sevilla, September 1996.
- Lattice Boltzmann method: a review with a glance to astrophysics, *Int. Workshop on "Cellular Automata Models: Prospects in Astrophysical Applications"*, Lieges, October 1992.
- Lattice Boltzmann Computing, *Europhysics Conference on Computational Physics*, Prague, CCP92, September, 1992.
- Lattice Boltzmann Computing, Opening speech at the *5th Symposium on Discrete Simulation of Fluid Dynamics*, Princeton, June 1992.
- Hydrodynamic behaviour of the Lattice Boltzmann Equation, *Workshop on "Numerical methods for the Simulation of Multi-Phase and Complex Flow"*, Shell Lab, Amsterdam, 1990.
- Cellular automata computing, *2st IBM Academic and Research Symposium on Large Scale Computing*, la Hulpe, Belgium, March 1988.

## 10 Didactical activity

- **Courses**

- Assistant to the Course of Plasma Physics I, Physics Department, *Ecole Polytechnique Federale de Lausanne*, 1984-85



- *Mathematical modeling and numerical simulation*, within the course "Istituzioni di Fisica Matematica", Math. Dept, University of Catania, October 1995
- *An Introduction to the Lattice Boltzmann Equation*, within the course "Fluidi ionizzati e gas rarefatti", Aerospace Eng. Dept, University of Rome "La Sapienza", June-July 1995.
- *An Introduction to the Lattice Boltzmann Equation*, within the course "Istituzioni di Fisica Matematica", Math. Dept., University of Parma, April 1996
- *Analisi Numerica*, Diploma in Chemical Engineering, Chem. Eng. Dept., Univ. of Rome "La Sapienza", 1996-97.
- *Analisi Numerica*, Diploma in Chemical Engineering, Chem. Eng. Dept., Univ. of Roma "La Sapienza", 1997-98.
- *Lattice Hydrodynamics*, within the course "Istituzioni di Fisica Matematica", Math. Dept., University of Parma, April 2000
- *Introduzione alla Fisica Computazionale*, Classe di Scienze Matematiche, Fisiche e Naturali, Scuola Normale di Pisa, 2000-1.
- *Complementi di Fisica Computazionale*, Classe di Scienze Matematiche, Fisiche e Naturali, Scuola Normale di Pisa, 2001-2.
- *Teoria Cinetica Computazionale dei Fluidi*, Post-graduate school of Mathematics for Industrial Applications, University of Roma, La Sapienza, 2002-3.  
item *Statistical theory of fluid turbulence*, within the course "Chemical Physics of Liquids", Scuola Normale di Pisa, a.y. 2002-3.
- *Numerical simulation of quantum gases*, within the course "Introduction to the theory of many-body systems", Scuola Normale di Pisa, a.y. 2003-4.
- *Fluid Dynamic applications of Lattice Gas Cellular Automata*, within the PhD Course in Mathematics for Industrial Technologies, Scuola Normale di Pisa, a.y. 2003-4.
- *Hydrokinetic theory*, within the PhD Course in Mathematics for Industrial Technologies, Scuola Normale di Pisa, 2004-5.
- *Numerical simulation of quantum gases*, within the course "Introduction to the theory of many-body systems", Scuola Normale di Pisa, a.y. 2004-5.
- *Numerical simulation of quantum gases*, within the course "Introduction to the theory of many-body systems", Scuola Normale di Pisa, a.y. 2005-6
- *Lattice hydrokinetic theory*, within the PhD Course in Mathematics for Industrial Technologies, Scuola Normale di Pisa, 2005-6.

- Coordinator of the course *Mathematical modelling in hydrology*, International Italian-USA degree in Hydraulic Engineering, Tuscia University, a.y. 2007-8.
- *The Lattice Boltzmann equation for fluid dynamics and beyond*, Fall Semester Course, (101-0690-011), ETH Zuerich, a.y. 2009.
- *Recent advances in Lattice Boltzmann simulation: classical, quantum and relativistic fluids*, Spring Semester Course, (101-0690-03V), ETH Zuerich, a.y. 2011.
- *Quantum relativistic kinetic theory*, Spring Semester Course, ETH Zuerich, a.y. 2012.
- *AC 274: Computational Modeling of Fluids and Soft Matter*, Harvard University, Fall term 2014.
- *AC 274: Computational Fluid Dynamics*, Harvard University, Fall term 2015.
- *Computational Thermodynamics*, Tuscia University, Spring term 2016.
- *Computational Physics*, Harvard University, Fall term 2016.

• **Series of lectures**

- *Introduction to the Finite Element Method*, II International School on "Advanced Techniques in Computational Physics", International Center for Theoretical Physics, Trieste, February 1988.
- *The FORTRAN Language*, Direzione Ricerca Scientifica e Tecnologica IBM Italia, Roma, 1989.
- *Lattice Gas Hydrodynamics*, Dottorato in Ingegneria Idraulica, Università' di Padova, 1989 and Genova, 1990.
- *Numerical Combustion*, as an invited professor at the Laboratoire de Modelisation en Mecanique, Université' Pierre et Marie Curie, Paris, January 1994.
- *Combustion Modelling*, Course on 'Mathematical Modeling for Industrial Applications', Consorzio Archimede, University of Catania, Catania, Sept. 1994.
- *An Introduction to Parallel Computing*, as a visiting professor at the Physics and Computer Science Dept, Chicago University, August 1995.
- *The Lattice Boltzmann Equation*, Computer Science Dept, Geneva University, February 1996.
- *Lattice simulation methods*, within the course "Fisica Molecolare", Phys. Dept, Univ. of Rome "La Sapienza", May 1998.
- *Lattice Hydrodynamics*, Classe di Scienze, Scuola Normale Superiore di Pisa, January 1999.

- *Kinetic methods for fluid dynamics*, Courses for the Master degree in Computational Fluid Dynamics, University of Rome II, June 1999.
  - *The Lattice Boltzmann Method*, Center for Computational Science, Amsterdam University, November 2001
  - *Industrial applications of the Lattice Boltzmann Method*, Master in Computational Fluid Dynamics, Center for Advanced Studies in Sardinia, November 2002.
  - *The Lattice Boltzmann Equation*, Mechanical Eng. Dept., Calgary University, Calgary, Canada, June 2004.
  - *The Lattice Boltzmann Equation: Basic theory and selected applications*, Mathematics Department, Taiwan National University, Taipei, February 2006.
  - *Introduction to lattice kinetic methods in fluid dynamics*, Jyvaskyla University, Jyvaskyla, Finland, August 2007
  - *An introduction to lattice kinetic equations*, International School on "An Introduction to Lattice Boltzmann methods for complex flow simulations", Roma, March 2008
  - *An introduction to computational multiphysics I*, Harvard University, March 2008. The lectures are available on YouTube and iTunes.
  - *An introduction to computational multiphysics II*, Harvard University, March 2009. The lectures are available on YouTube and iTunes.
  - Lattice kinetic methods for microfluidics GASMEMS Summerschool, Bertinoro, Italy, May 2011.
  - Mesoscopic particle methods, COST Training School on Stochastic Methods in Fluid Mechanics, International Center for Mechanical sciences, Trento, Italy, July 2012.
  - Lattice Boltzmann as a tool of discovery, NORDITA, Stockholm, May 2012.
  - Lattice Boltzmann for CFD Graduate School in Fluid Mechanics linked to the Excellence Centre FLOW at KTH Stockholm, September 2012.
  - *A Crash-course on lattice Boltzmann, in his own city!* Erwin Schroedinger Institute, Vienna, May 2013.
  - *Multiscale Lattice Boltzmann*, COST-Training School, Madrid, May, 2015
- *Alia*
    - Co-supervisor of over 30 (master and PhD) thesis works in Mathematics, Physics and Engineering at the Universities of Rome I,II, Catania and Florence.

- Foreign Member of 20 PhD Thesis Jury Committees in Italy (4) Switzerland (9), Germany (2), Finland (1), Ireland (1), Norway (1), Holland(1), Canada(1).
- Qualified to apply to university professor positions in France, as per the positive pronouncement of the Evaluation Committee appointed by the French Ministry of Higher Education and Research (March 1994).

## 11 Description of my scientific activity

My research activity is centered around the study of dynamical systems far from equilibrium, including thermonuclear plasmas, turbulent and reactive flows, quantum fluids, relativistic fluids and biological systems as well. The underlying technical thread of such a research is mathematical modeling, statistical mechanics and computer simulation.

The major highlights of my scientific activity are summarized below.

### 11.1 Plasma physics

- *Plasma-heating in nuclear fusion*

I contributed to Monte Carlo simulations of heating in fusion plasmas via injection of neutral particle beams in the diverted Tokamak reactor ASDEX ([3]).

- *Beta-limits in nuclear fusion*

I contributed to an extensive program of magneto-hydrodynamic simulations which culminated with the assessment of the maximum amount of electric current which can be supported by a Tokamak plasma as a function of the applied magnetic field (see [4]). This stability limit is nowadays regarded as one of the classical results of the nuclear fusion literature over the lasty twenty years (nearly 450 entries in the ISI citation list, as of August 2013).

- *Radio-frequency current drive*

In the course of my PhD work, we provided the first numerical evidence that even a small amount of radio-frequency power at the appropriate wavelength, can sustain a substantial amount of plasma current (paper [5]). The resulting computer code has been exported to the Joint European Torus, the largest nuclear fusion facility in Europe, for routinely use in support to the experimental activity ([9]).

## 11.2 Kinetic theory

- *Lattice Boltzmann method for fluid dynamics*

Together with F. Higuera (Madrid), we performed the earliest calculation ever published in a scientific journal, proving the viability of the newborn Lattice Boltzmann method for fluid dynamics (paper [24]). Shortly after (paper [25]), together with R. Benzi, we developed a more flexible version which opened the way to fully three-dimensional, high-Reynolds number fluid dynamic simulations. More importantly, this work was the first to put forward the so-called “top-down” approach, namely the idea that efficient mesoscopic models can be designed on the sole requirement of compliance with macroscopic dynamics, with no need of retaining inessential micro-dynamic constraints. This top-down approach has proved very influential for all subsequent developments in the field.

Work to enhance the theoretical span (H-theorem, nonlinear stability) and the computational power of the method (non-uniform grids, fast steady-state solvers) and to broaden its range of applications (combustion, thermo-hydrodynamics, granular flows, flows with phase-transitions, possibly even quantum physics) constituted the bulk of my research activity for the next decade.

In 2001, I published the book ‘Lattice Boltzmann equation for fluid dynamics and beyond’, (S. Succi, Oxford University Press, June 2001), the earliest monograph on the subject. The book is serving as a classical reference for the field, as witnessed by its substantial citation rate (nearly 2700 ISI cites as of August 2013). A similar role is played by the earliest review on the subject, Benzi-Succi-Vergassola, Phys. Rep. 1992, which contains many original ideas still valid to this day (the paper shows a rising citation rate, with over 850 ISI cites, as of August 2013).

- *Lattice Boltzmann for quantum mechanics and quantum field theory*

Based on the observation that the Schroedinger equation follows from Dirac’s equation under the same mathematical assumptions taking the Boltzmann equation into the Navier-Stokes equations, we have developed a discrete lattice Boltzmann model for complex-valued distribution functions reproducing non-relativistic and relativistic quantum motion (papers [44, 60, 113]). The method might bear some interest as a theoretical algorithm for simulating physics on quantum computers and has been recently extended to two and three-dimensional situations ([185]), as well as to (1+1)-dimensional quantum field theory ([184]).

- *Relativistic kinetic theory*

In collaboration with the group pf Prof. Hermann at ETH Zuerich, we have developed the first relativistic version of the lattice Boltzmann equation. Applications as diverse as supernovae explosions and shock propagation in quark-gluon plasmas have been performed, highlighting the

outstanding computational efficiency of the method (see *M. Mendoza et al, Phys. Rev. Lett. 105, 014502, 2010, and Phys. Rev. D, 82, 105008, 2010*).

### 11.3 Fluid dynamics

- *Extended self similarity in fluid turbulence*

We have argued ([46, 64]) that turbulent flows exhibit a kind of generalized self-scaling symmetry which goes beyond the classical Kolmogorov scale-invariance theory. This generalized symmetry, now known as Extended Self-Similarity (ESS), has been explored by several experiments (among others, Ecole Normale Superieure Lyon, Rome and Yale University). ESS has established itself as a powerful data analysis tool to compute the scaling exponents of fluid turbulence (and extended non-linear systems in general) with a much better statistical accuracy than previously available.

- *Kinetic approach to turbulence modeling*

Together with Steven Orszag, Hudong Chen, and other colleagues in the USA, we have developed a new approach to turbulence modeling based on an expanded analogy between kinetic theory and fluid turbulence (see [84, 126, 137]). Although a fully fledged theory remains to be developed, this effort has already met with significant agreement with computer simulations of real-life turbulence flows. The basic ideas, as well as the accompanying numerical results, have made the object of a publication in the Science magazine ([126]).

- *Rayleigh-Benard and channel flow turbulence*

Using the Lattice Boltzmann method on massively parallel computers, we investigated the statistical properties (energy spectra, velocity and temperature probability distribution function, scaling laws) of thermal turbulence in Rayleigh-Benard cells. In particular, by means of ESS analysis, we provided evidence that thermal turbulence obeys its own scaling laws (Bolgiano scaling) quite distinct from those pertaining to isothermal turbulence (Kolmogorov scaling). See papers [46, 54]. A similar lattice Boltzmann code has been used for years on the massively parallel computer APE to perform high-resolution direct numerical simulations of channel flow turbulence (see [62, 66]). As of today, the LB method is the workhorse for computational fluid dynamics on APE, the massively parallel super-computer designed by the Italian National Institute of Nuclear Energy (Prof N. Cabibbo and G. Parisi) for Lattice Quantum Chromodynamics simulations.

- *Fluid transport in disordered media*

Together with Prof D. Rothman (MIT), we performed the earliest Lattice Boltzmann simulations of fluid flows in porous media taking into account microgeometrical details of the porous structure in three dimensions (see

[26, 32]). These simulations permitted to investigate porosity regimes normally inaccessible to semi-analytical statistical models, and constitute a valuable complement/alternative to experimental data. They also pioneered the use of Lattice Boltzmann techniques in what was later to become one of its most fruitful application areas.

- *Cosmological fluid-dynamics*

Together with colleagues at IAC (D. Bini et al), I have recently started to investigate the effect of friction forces in cosmological models (D. Bini et al, *Europ. J. Phys. C*, 73, 2334, 2013), as well as cosmological models with non-ideal fluids, (D. Bini et al, *Phys. Rev. D*, 90, 044021, 2014).

## 11.4 Multiscale modelling of complex flows

In the recent years, the LB method has made proof of a remarkable versatility for the description of complex material/fluid motion across scales, from fully-developed turbulent flows in real-life complex geometries, to non-equilibrium microflows, all the way down to nanoflows of biological interest. Such remarkable versatility, configures LB not only as an efficient hydrodynamic solver, but as a fully-fledged simulational strategy, capable of providing quantitative insights into the physics of a broad class of complex systems across scales of motion. Our work in Rome has been central in demonstrating these cross-scale capabilities on quantitative grounds ( See, among others, *Sbragaglia et al, PRL 97, 204503, 2006*).

- *Multiscale hemodynamics*

In collaboration with Dr W. Miller (Berlin), we have developed mesoscopic Lattice Boltzmann (LB) models for flows with liquid-solid phase transitions ([101, 110, 145]). Together with Prof Kaxiras at Harvard, we have developed multiscale models of reactive microflows in complex geometries ([103, 105]). A general outline of multiscale applications based on the LB method is given in ([104]). More recently the Lattice-Boltzmann-Molecular-Dynamics MUPHY code, originally designed for biopolymer dynamics (see below), has been extended to the case of large-scale cardiovascular flows in anatomically realistic geometry of direct relevance to medical doctors (see [214]). This has led to the first simulation of the full heart-circulation system at near red-cell resolution. **The papers [250] and [272] have been selected as a finalists of the 2010 and 2011 editions of the Gordon Bell Prize in Supercomputing.** The latter has won an Honorable mention.

- *Micro and nano-flows*

We have formulated the first multiscale model, coupling LB with constrained molecular dynamics for *long* generic biopolymers (see M. Fyta et al, *Multiscale Modeling and Simulation*, 2006 [179]). The marriage

between these two powerful methods results in a very efficient computational technique, which permits to account for hydrodynamic effects at a linear cost in the number of molecular degrees of freedom, thereby opening the way to the simulation of long molecules of biological interest. Using this new multiscale method, we have simulated a number of nano-fluidic systems of biological interest, such as biopolymer translocation across nanopores and bio-membranes ([197, 216]). *This work [183] has received the Best Paper Award at the 7th Int. Conference in Computer Simulation, Beijing, May 2007, one of the major events in computational science worldwide.* A parallel version of the code has also been developed and simulated on the massively parallel Blue-Genie supercomputer, reaching up to nearly 10 Teraflops sustained performance. Our team in Rome has also been on the forefront of the recent developments which have taken LB into the rich territory of supra-hydrodynamic, non-equilibrium flows. In particular, *Toschi-Succi, EPL, 69, 549, 2005*, provided the first evidence that LB can quantitatively reproduce the well-known Knudsen paradox, an universally agreed signature of post-hydrodynamic behaviour. Moreover, *Sbragaglia-Succi, Phys. Fluids, 17, 093602, 2005*, developed a general analytical formulation of the appropriate kinetic boundary conditions for the LB simulation of microflows at finite-Knudsen. We have also provided quantitative evidence that the hydrokinetic Lattice Boltzmann approach correctly captures the essential features of a variety of micro-nanoflows, which do not fit the continuum hydrodynamic picture, and yet cannot be described by atomistic methods for want of computational power ([166, 174, 201, 213]).

## 11.5 Condensed matter and atomic physics

- *Bose-Einstein condensation*

I supervised the development of theoretical numerical solvers for the Gross-Pitaevski equation (GPE), a specific type of non-linear Schroedinger equation of direct relevance to the dynamics of Bose-Einstein atomic condensates in the zero-temperature limit. In particular, together with the team of Prof Tosi in Pisa, we have developed a fast explicit solver which preserves unitarity also in the presence of non-linear interactions, such as those occurring in the GPE. This method has been used in collaboration with Scuola Normale di Pisa, for the theoretical and numerical study of the ground-state and transport properties of Bose condensates in optical lattices ([89, 94, 98]).

- *Thermal excitations in quantum gases*

Besides transport properties at zero temperature, we have also developed hybrid finite-difference-Montecarlo methods to investigate the dynamics of thermal excitations of Bose-Einstein condensates and Fermi vapors at non-zero temperature ([124, 130]). Our activity in the field has been collected in a review paper in Physics Reports ([140]).



- *Analogue models of black holes*

In collaboration with Prof Tosi in Pisa, we have explored the analogies between sound propagation in BEC vortices and scattering processes from black holes. In particular, we have shown that a significant amount of energy can be extracted from rotating BEC vortices via the Penrose-Zeldovich's mechanism of superradiance ([151, 162]).

## 11.6 Theoretical biology

- *Immune system dynamics*

We have developed a scalable parallel version of the Celada-Seiden cellular automaton, one of the most realistic mathematical models of the immune system dynamics. Subsequently, we have applied some theoretical tools of statistical physics to the interpretation of the immune system response to antigen attacks (see papers [69, 85, 86]).

- *Intracellular signal transduction*

In collaboration with Prof M. Kirschner (Cell Biology, Harvard Med School) we have developed reactive cellular automata tools for the simulation of intracellular signal transduction, namely the mechanism by which extracellular signals are transported from the cell membrane to the nucleus and then converted into cellular responses ([118]).

## 11.7 High-performance computing

- *Parallel industrial fluid-dynamics*

Parallel computing has been the common thread underlying all of my activities at IBM. In particular, I took part to early application work with third-parties fluid dynamics codes using distributed memory parallel computers, from cluster of workstations up to the IBM 9076 SP2 parallel computer (see [53, 61]). This activity made the object of several international cooperations with leading european software companies, industries and research institutions (Computational Dynamics, AVL, Daimler-Benz, Meteofrance, Shell Research).

- *Massively parallel combustion*

I have been supervising PhD work at the Aerospace and Mechanical Engineering Dept. at the University of Rome for the development of numerical combustion applications on massively parallel computers.

- *Mathematical models and software tools for reactive flow analysis*

For several years at IBM ECSEC I've been coordinating the development of advanced software environments for combustion problems of direct industrial relevance. In the course of this activity, the package KIVA++

has been developed, which made the object of a few contracts with leading european industries in the automotive sector (Renault, Piaggio, Diesel Ricerche). On a more academic side, I've been developing/experimenting innovative algorithms for multiphase flows (paper [57]). In addition, together with Prof K. Molvig and coworkers, (Nucl. Eng. Dept. MIT, and EXA Corporation (Boston)) I have been developing mathematical models extending the *Digital Physics* paradigm to the case of flows with chemical reactions (see [81, 91]). Some of these models, and resulting algorithms, have been incorporated within the commercial Lattice-Boltzmann code POWERFLOW (trademark EXA Corporation), now leading the world market for aerodynamic CFD (Computational Fluid Dynamics) design.

## 12 Other professional activities

### Referee

- *Scientific Journals*
  - Acta Applicandae Mathematicae
  - Acta Materialia
  - Acta Mechanica Sinica
  - ACS nano
  - Advances in Space Research
  - Archives of Mechanics
  - Applied Mathematics and Computing
  - Applied Mathematics Research Express
  - Applied Mathematical Modeling
  - Biophysical Journal
  - Chaos, Solitons and Fractals
  - Chemical Physics Letters
  - Chemical and Engineering Science
  - Colloids and Surfaces
  - Comptes Rendus Academie Francaise
  - Communications in Mathematical Physics
  - Communications in Nonlinear Science and Numerical Simulation
  - Computers and Fluids
  - Computers in Physics
  - Computers and Electroncis in Agriculture
  - Computer Methods in Applied Mechanics and Engineering

- Computer Physics Communications
- Continuum Mechanics and Thermodynamics
- Discrete Applied Mathematics
- Engineering with Computers
- Entropy
- Europhysics Letters
- European Physical Journal E- Soft Matter
- Future Generation of Computer Systems
- IBM System Journal
- International Journal of Computational Fluid Dynamics
- International Journal of Computer Research
- International Journal of Modern Physics C
- International Journal of Thermal Sciences
- International Journal of Heat and Fluid Flow
- Journal of Applied Physics A
- Journal of Biomechanics
- Journal of Chemical Physics
- Journal of Chinese Letters
- Journal of Colloid and Interface Science
- Journal of Computational Science
- Journal of Condensed Matter
- Journal of Marine Science and Technology
- Journal of Physical Chemistry
- Journal of Porous Media
- Journal of Computational Physics
- Journal of Computational Science
- Journal of Heat and Fluid Flow
- Journal of Fluid Mechanics
- Journal of Fluids and Structures
- Journal of Material Engineering and Performance
- Journal of Non-Newtonian Fluids
- Journal of Petrol and Research Engineering
- Journal of Physics A
- Journal of the Royal Society Interface
- Journal of Scientific Computing

- Journal of Statistical Physics
- Journal of Statistical Physics: Theory and Experiments
- Journal of Turbulence
- Macromolecules
- Meccanica
- Mechanics Research Communications
- Microfluidics and Nanofluidics
- Molecular Physics
- Molecular Simulation
- Multiscale Modeling and Simulation
- Nature Physics
- New Journal of Physics
- Numerical algorithms
- Numerical methods for partial differential equations
- Physica A
- Physica D
- Physica Scripta
- Physical Review Letters
- Physical Review Applied
- Physical Review E (Statistical Physics)
- Physical Review B (Condensed Matter)
- Physical Review D (Particles and Fields)
- Physics Letters A
- Physics of Fluids
- Physics Reports
- Philosophical Transactions of the Royal Society, London
- Plos
- Proceedings of the National Academy of Science, USA
- Research Letters in Physics
- Scientia Iranica
- SIAM Review
- SIAM J. of Scientific Computing
- SIAM J. of Applied Mathematics
- SIAM J. of Multiscale Modeling and Simulation
- Transport in porous media

- Transport Theory and Statistical Physics
- Trends in Biotechnology
- Water Resources Research
- Zeitschrift fuer Angewandte Mathematik
- Zeitschrift Angewandte Matematik und Physik
- *Academic Institutions, Research Awarding and Funding Organizations*
  - University of California Berkeley
  - Pope Fellowship Reviewer, Univ. of Nottingham, UK
  - Romanian National Authority for Scientific Research and Innovatio
  - Swiss Supercomputing Center
  - Indian Center of Science Education and Research
  - The Partnership for Advanced Computing in Europe (PRACE)
  - Stony Brook University
  - Princeton University
  - Columbia University
  - Jawarhal Nehru Research Center, India
  - Netherlands e-Science Center
  - Swiss Polytechnic Institute Zuerich
  - Ministry of Education, Hellenic Republic
  - Faculty Evaluator, Haverford College (USA)
  - International Center of Theoretical Physics (ICTP), Trieste
  - Deutsche Forschung Gesellschaft
  - Centre Europeen de Calcul Atomique and Moleculaire (CECAM), Switzerland
  - Academy of Finland
  - Academie Wallonie-Bruxelles, Belgium
  - American University in Armenia
  - Israeli Science Foundation
  - Philip Leverhulme Prize Foundation (UK)
  - Trinity College, Cambridge (UK)
  - Research Council of Canada
  - Branco-Weiss Foundation, (Switzerland)
  - Josef Krainer Prize, (Austria)
  - Paul-Scherrer Institute, (Switzerland)
  - Tata Institute of Fundamental Research, (India)

- Alexander von Humboldt Foundation, (Germany)
- NATO Scientific Exchange Program
- INFN (National Institute for the Physics of Matter)
- MURST (Italian Ministry for University and Research)
- NSF (National Science Foundation, USA)
- ESF (European Science Foundation)
- Hong-Kong Research Council
- Swiss National Science Foundation, (Switzerland)
- Dutch Basic Science Funding Program, (The Netherlands)

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• *Scientific Book Publishers*

- Springer Verlag
- CRC Press

**Editorial activity**

Associate Editor of:

- **2014-** *Journal of Computational Science*
- **2013-** *Scientific Reports*
- **2013-** *Frontiers of Computational Physics*
- **2012-** *EPL Advisory Board*
- **2012-** *Computation*
- **2008-** *Journal of Statistical Physics: Theory and Experiment*
- **2007-2012** *Europhysics Letters (Stat. Mech. and Applied Math.*
- **2005-** *Communications in Computational Physics*
- **2005-** *Physica A: Statistical Mechanics and its Applications*
- **1999-** *Journal of Applied Rheology*
- **1998-** *International Journal of Modern Physics C*
- **1996-** *Journal of Scientific Computing*
- Special Issue of Entropy on "Physics on non linear lattices", 2015
- Guest co-editor of the Special Issue: Proceedings of the DSFD2013 Conference, Comm. in Comp. Phys., vol. 13, n. 3, 2013.

- Guest co-editor of the Theme issue Discrete Simulation of Fluid Dynamics: Methods, Phil. Trans. Royal Soc. A, vol. 369, n. 1944, 2011.
- Guest co-editor of the Theme issue Discrete Simulation of Fluid Dynamics: Applications, Phil. Trans. Royal Soc. A, vol. 369, n. 1945, 2011.
- Guest co-editor of the special issue of Applied Numerical Mathematics, Proceedings of DSFD2005, 14th edition of Discrete Fluid Dynamics Conference, Kyoto, 2005.
- Guest co-editor of the special issue of the Proceedings of Discrete Modelling and Simulation of Fluid Dynamics, Phil. Trans. Royal Soc. A: Math., Phys., Eng. Sciences, March 2002, following upon Europhysics Abstracts volume 25H, Discrete simulation of fluid dynamics, new trends, new perspectives, Cargese, 2001.
- Guest co-editor of the special issue of Transport Theory and Statistical Physics, vol. 23, n.1-3, 1994, Proceedings of Euromech Colloquium n.287, Discrete Models in Fluid Dynamics.

#### **Board and Committee Nominations**

- Chairman of the Scientific Advisory Board of the UK Consortium on Mesoscale Engineering Sciences (COMES), 2013.
- Member of the scientific board of SCIRE: Scientific Consortium for Industrial Research, (FIAT Elasis-University of Rome),2001-2.
- Member of the National Research Council committee for national fellowship assignment, Mathematics Group, October 1996.
- Member of the Scientific Board of "Consorzio Archimede", (IBM-Finisiel-Catania University), 1993-95.
- Chairman appointed by IBM Europe of the IBM Summer Institute on Computational Fluid Dynamics (Oberlech, August 1992)
- Member of the special committee on "Environmental Modelling Project", appointed by the CRS4 (Centro Ricerche Sviluppo Studi Superiori Sardegna), (1991)
- Chairman appointed by the European Mechanic Council, of EUROMECH 287 "Discrete Models in Fluid Dynamics: theory, numerical simulation, experiment", (Cagliari, Sept. 1992)
- Member of Scientific Advisory Committee of Physics Computing '94, appointed by Computational Physics Group, European Physical Society, 1994.

- Member of Scientific Committee of the Symposium "Automi cellulari per Ricerca e Industria", Rende (Italy), September 1994.
- Member of Scientific Committee of "Discrete Models in Fluid Mechanics", Princeton, June '94.
- Chairman of the tutorial on "Programming Tools in High performance Computing", High Performance Computing and Networking European conference, Milan, May 1995.
- Chairman of the 'Special Technological Session' on Parallel Computing, ECCOMAS conference, Paris, Sept. '96.
- Member of Scientific Committee of the Euroconference "Microscopic approach to complexity in non-equilibrium molecular simulations", Lyon, July '96.
- Member of Scientific Committee of the Symposium "Automi cellulari per Ricerca e Industria", Milan (Italy), October 1996
- Member of the National Research Council committee for international fellowship assignement, Mathematics Group, April 1997
- Member of the scientific committee of the Year Study "Mathematical Problems in Fluid Dynamics", Rome, July, 1997
- Member of the scientific committee on "Discrete simulation of Fluids", Oxford, July 1998.
- Member of the european organizing committee of "ECCOMASS 98", Athens, Sept. 1998,
- Member of the organizing committee of "High-Performance Computing Symp.", Boston, April 1998.
- Member of the organizing committee of "High-Performance Computing Symp.", San Diego, April 99.
- Member of the organizing committee of "8th International Conference on the Discrete Simulation of Fluids", Tokyo, July 1999,
- Member of the organizing committee of "High-Performance Computing Symp.", Washington D.C., April 2000.
- Member of the organizing committee of "9th International Conference on the "Discrete Simulation of Fluids", Santa Fe, August 2000.
- Member of the organizing committee of "High-Performance Computing Symp.", San Diego, April 2001.
- Member of the scientific committee of the Int. Symp. "Bridging the time scales", Konstanz, September 2001.



- Chairman of the scientific committee of the "10th Conference on the Discrete Simulation of Fluids", Cargese, France, July 2001.
- Member of the Scientific Committee of Center for Advanced Studies, Research and Development in Sardinia, (2001).
- Member of the National Research Council Selection Committee for the appointment of a permanent research position at Istituto Applicazioni Calcolo (2001).
- Member of the scientific committee, Picone Lectures, Roma, 2002
- Member of the organizing committee of "High-Performance Computing Symp. 2002", San Diego, April 2002.
- Member of the Jury committee of the thesis work by Dr. A. Dupuis, Computer Science Dept., Geneva University, June 2002.
- Member of the International scientific committee, 11th Conference on the Discrete Simulation of Fluids, Beirut, 2003.
- Member of the International scientific committee, Int. Conf. Comp. Sci. ICCS 2003, Minisymposium on Lattice Boltzmann methods, St Petersburg, 2003.
- Member of the International scientific committee, Conference on Computational Physics 2004, Genoa, Italy, Sept. 2004.
- Member of the international scientific committee, INFM Meeting, Genoa, Italy, June 2004.
- Member of the International scientific committee, 12th Conference on the Discrete Simulation of Fluids, Boston, 2004.
- Co-chairman of the minisymposium on Advances in Discrete Kinetic Theory, National Symp. of Italian Industrial and Applied Math Soc., Venice, Sept. 2004.
- Co-chairman of the minisymposium on Lattice Boltzmann methods, 3rd MIT Conference on Computational Fluid and Solid Dynamics, Boston, USA, June 2005.
- Member of the international scientific committee, Int. Conf. on Comput. Heat and Mass Transfer, Paris, May 2005.
- Member of the International scientific committee, 13th Conference on the Discrete Simulation of Fluids, Kyoto, August 2005.
- Member of the International scientific committee, 14th Conference on the Discrete Simulation of Fluids, Geneva, August 2006.

- Member of the International scientific committee, 15th Conference on the Discrete Simulation of Fluids, Banff, August 2007.
- Member of the International scientific committee, Conference on Computational Physics 2007, Brussels, Belgium, Sept. 2007.
- Chairman of the European Science Foundation Workshop "Microfluidics: Theory and Experiments", Frascati, September 2007.
- Member of the International scientific committee, 16th Conference on the Discrete Simulation of Fluids, Florianopolis, Brasil, August 2008.
- Member of the International scientific committee, 17th Conference on the Discrete Simulation of Fluids, Beijing, China, July 2009
- Member of the International scientific committee, 1st Black Forest Conference on Soft Matter Simulation, Freiburg, Germany, July 2009
- Chairman of the 18th Conference on the Discrete Simulation of Fluids, Roma, July 2010.
- Co-organizer of the workshop "Multiscale Fluid Dynamics with Lattice Boltzmann", Lorentz Center, Leiden University, February 2011.
- Member of the International Committee of the 19th Conference on the Discrete Simulation of Fluids, Fargo, USA, July 2011.
- Member of the International Committee of the 21th Conference on the Discrete Simulation of Fluids, Bangalore, India, July 2012,
- Member of the International Scientific/Advisory Committee of Conference on Mathematical Modeling in Physical Sciences, Budapest, 2012
- Reviewer of the Italian SuperComputing Resource Allocation (ISCRA) initiative, 2013
- Member of the International Committee of the 22th Conference on the Discrete Simulation of Fluids, Yerevan, Armenia, July 2013
- Member of the International Committee of the 23th Conference on the Discrete Simulation of Fluids, Paris, July 2014
- *Member of the Organizing Committee of the Solvay Symposium on Multiscale Modelling at the Biology/Chemistry/Physics interface, Brussels, April 2016.*

## 13 Visiting activity

### Visiting scientist appointments

- Visiting professor at the Laboratoire de Modelisation en Mecanique, Universite' Pierre et Marie Curie, Paris, January '94, (Host: Prof *S. Zaleski*)
- Visiting professor at the Computer Science and Physics Depts, Chicago University, August '95 (Host: Prof *L. Kadanoff*)
- Visiting scientist at MIT Nucl. Eng. Dept and EXA Corporation, Cambridge, USA, August 1996 (Host: Prof *K. Molvig*)
- Visiting scientist at MIT Nucl. Eng. Dept and EXA Corporation, Cambridge, USA, August 1997 (Host: Prof *K. Molvig*)
- Visiting scientist at EXA Corporation, Cambridge, USA, August 1998 (Host: Dr *S. Remondi*)
- Visiting scientist at Center for Non Linear Studies, (Host: Prof *S. Chen*), Los Alamos, USA, open
- Visiting scientist at Centre Europeen Calcul Atomique and Moleculaire, (Host: Prof *M. Mareschal*, open)
- Visiting scientist at Nasa Larc Center, (Host: Dr *L. Luo*) Virginia, USA, open
- Visiting scientist at EXA Corporation, Cambridge, USA, August 2001 (Host: Dr *S. Remondi*)
- Visiting scientist at EXA Corporation, Cambridge, USA, August 2002 (Host: Dr *S. Remondi*)
- Alexander von Humboldt fellow at the Institute for Crystal Growth, Berlin, July 2003 (Host: Dr *W. Miller*)
- Alexander von Humboldt fellow at the Institute for Crystal Growth, Berlin, July 2004 (Host: Dr *W. Miller*)
- Johannes Gutenberg University, Mainz, Germany, (Host: Prof *K. Binder*)
- Computational Science Department, National Singapore University, Singapore, August 2005 (Host: Prof *T. Chu*)
- Aeronautic Engineering Department, Kyoto, August 2005 (Host: Prof *T. Inamuro*)
- Institute of Applied Physics and Computational Mathematics, Beijing, November 2007 (Host: Dr *A. Xu*)

- Freiburg Institute for Advances Studies, Freiburg, November 2008 (Host: Pr *J. Korvink*)
- Jawaharlal Nehru Center for Advanced Scientific Research, Bangalore, India, December 2010 (Host: Pr *C.N.R. Rao*)
- Erwin Schrodinger Institute for Mathematical Physics, Vienna, May 2013 (Host: Pr *C. Dellago*)

#### **Standing invitations**

- Physics Dept, Johannes Gutenberg University, Mainz, Germany, standing invitation, (Host: Prof *K. Binder*)
- Chemistry Dept., Cambridge University, standing invitation, (Host: Prof *J.P. Hansen*)

#### **Short visits**

- Physics Dept., UCLA(\*), June 1988, (Host: Prof. *J. Dawson*)
- Fluid Dynamics Research Center, Princeton University, June 1994, (Host: Prof *S. Orszag*)
- Hanscom US Air Force Research Center, Hanscom (Massachusetts), July 1995, (Host: Dr *J. Yezep*)
- IBM T.J. Watson Research Center, Yorktown Heights (NY), July 1996, (Host: Dr *S. Chen*)
- Fluid Dynamics Research Center, Princeton University, December 1996, (Host: Prof *S. Orszag*)
- Aerospace and Mechanical Engineering Dept., Boston University, November 1997, (Host: Prof *S. Orszag*)
- Institute of Applied Energy, Tokyo February 1998, (Host: Prof *K. Ohashi*)
- Physics Dept., Oxford University(\*), Oxford, UK, June 1998, (Host: Prof *J. Yeomans*)
- Mathematics Dept., Yale University, Yale, USA, Nov. 1998, (Host: Prof *S. Orszag*)
- Centre Europeen Calcul Atomique et Moleculaire, Lyon, December 1998, (Host Prof *M. Mareschal*)
- Classe di Scienze, Scuola Normale di Pisa, Pisa, Italy, Jan. 1999, (Host: Prof *M. Tosi*)

- Center for Computational Science, Boston University, USA, April 1999, (Host: Prof *C. Rebbi*)
- ERCOFTAG visitor, Leonard Euler Center, IMHEF, Ecole Polytech. Federale Lausanne, Lausanne, Suisse, June 1999, (Host: Prof *M. Deville*)
- Physics Department, Harvard University, Cambridge, USA, August 1999 (Host: Prof *E. Kaziras*)
- Computational Science Center, Queen Mary College, London, March 2000, (Host: Prof *P. Coveney*)
- Chemistry Department, Queen Mary College, London, May 2001, (Host: Prof *A. Shezdar*)
- Center for Computational Science, Amsterdam University, November 2001, (Host: Prof *D. Frenkel*).
- Mechanical Engineering Department, Calgary University, Calgary, June 2004 (Host: Prof *M. Mohamad*)
- Chemical Engineering Department, Princeton University, Princeton, December 2004, (Host: Prof *Y. Kevrekidis*)
- Computational Science Department, National Taiwan University, Taiwan, August 2005 (Host: Prof *J. W. Yang*)
- EXA Corporation, Physics Group, June 2006, (Host: Dr *H. Chen*)
- EXA Corporation, Physics Group, October 2007, (Host: Dr *H. Chen*)

(\*) Not undertaken because of contingent inconveniences.

## 14 Alia

### Affiliations

- Societies
  - European Physical Society
  - American Physical Society
  - Italian Scientists and Scholars of North America Foundation (ISS-NAF) (2012-)
  - Harvard academia.edu

- Italian Society for Industrial and Applied Mathematics (1994-98)
- New York Academy of Science (1998-2001)
- Society of Industrial and Applied Mathematics (1994-98)
- Institutions
  - Physics Department, University of Rome
  - Istituto Nazionale Fisica della Materia, through the Unit of Scuola Normale di Pisa (1998-2006)
  - Istituto Nazionale Fisica Nucleare, (2012-)

### **Foreign Languages**

English (fluent)  
French (fluent)  
German (basic)  
Spanish (notions)

## 15 Dr Sauro Succi: Publications

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