

Curriculum Vitæ of Marco Storace

Personal details

Address:

Biophysical and Electronic Engineering Department
University of Genoa
Via Opera Pia 11a, Genova, Italy, I-16145
Phone: +39-010353-2079 (off.) -2276 (lab.)
Fax: +39-010353-2290
E-mail: marco.storace@unige.it

Date of and place of birth: 25/04/1969, Genoa, Italy

Nationality: Italian

Status: Married. Two daughters: Annachiara 07/10/2003, Nicoletta 17/05/2005. One son: Giorgio 03/09/2006

Brief Career History

- 2011- Full Professor. Department of Naval, Electrical, Electronic and Telecommunications Engineering, University of Genoa.
- 2004-2011 Associate Professor. Biophysical and Electronic Engineering Department, University of Genoa.
- 2000-2003 Lecturer. Polytechnic of Milan.
- 1999-2004 Research Assistant and Lecturer. Biophysical and Electronic Engineering Department, University of Genoa .
- 1998 Visitor at the Laboratory of Nonlinear Systems of the École Polytechnique Fédérale de Lausanne, supervisor Prof. Martin Hasler. Research activity on: "Stochastic resonance and chaotic systems". Sponsored by the University of Genoa.
- 1998 Postdoctoral Research Assistant in the *Biophysical and Electronic Engineering Department*, University of Genoa.
- 1994-1997 PhD. in Electrical Engineering, University of Genoa. Thesis title *Circuit modelling of nonlinear systems*, supervisor Prof. Mauro Parodi.
- 1994 M.Sc. 5-year degree in Electronic Engineering, University of Genoa. Graduated with first class honours (Summa Cum Laude).

Current Research Interests

- Modelling and circuit synthesis of devices and systems for engineering applications (e.g., circuit implementation of models of biological neurons)
- Piecewise-linear (PWL) approximation techniques and circuit implementation of PWL n-variate functions for engineering applications (e.g., emulation of nonlinear dynamical systems, information compression in wireless sensor networks, nonlinear control systems)
- Smooth, Hybrid and Piecewise-smooth dynamical systems
- Bifurcations of smooth and nonsmooth systems
- Electronic oscillators: design optimization based on bifurcation analysis
- Identification of nonlinear dynamical systems
- Analysis, Synchronization and Control of Complex Networks

12 most significant publications

Bifurcation analysis of continuous-time dynamical systems

-) M. Storace, D. Linaro, E. de Lange, "The Hindmarsh-Rose neuron model: bifurcation analysis and piecewise-linear approximations," *Chaos*, vol. 18, n. 3, pp. 033128(1-10), Sept. 2008.
-) A. Oliveri, A. Stocchino, M. Storace, "Barriers to transport induced by periodic oscillations in a physical model of the human vitreous chamber," *Physical Review E*, vol. 83, pp. 036311(1-5), 2011, doi: 10.1103/PhysRevE.00.006300.

Bifurcation analysis of discrete-time dynamical systems

-) F. Bizzarri, M. Storace, L. Gardini, "Bifurcation analysis of a circuit-related generalization of the shipmap," *International Journal of Bifurcation and Chaos*, vol. 16, No. 8, pp. 2435-2452, 2006.

Piecewise-linear approximation of nonlinear dynamical systems

-) M. Storace, O. De Feo, "Piecewise-linear approximation of nonlinear dynamical systems," *IEEE Transactions on Circuits and Systems-I: Regular Papers*, vol. 51, No. 4, pp. 830-842, April 2004.

Modelling of biological neurons

-) D. Linaro, M. Storace, M. Giugliano, "Accurate and fast simulation of channel noise in conductance-based model neurons by diffusion approximation," *PLoS Computational Biology*, vol. 7(3), pp. e1001102(1-17), March 2011, doi: 10.1371/journal.pcbi.1001102.

Identification of nonlinear dynamical systems

-) D. Linaro, M. Storace, M. Mattia, "Inferring network dynamics and neuron properties from population recordings," *Frontiers in Computational Neuroscience*, vol. 5, paper 43, pp. 1-17, September 2011, doi: 10.3389/fncom.2011.00043.

Circuit implementation of piecewise-linear n-variate functions

-) M. Parodi, M. Storace, P. Julián, "Synthesis of multiport resistors with piecewise-linear characteristics: a mixed-signal architecture," *International Journal of Circuit Theory and Applications*, vol. 33, No. 4, pp. 307-319, Jul.-Aug. 2005.
-) M. Storace, T. Poggi, "Digital architectures for the circuit implementation of PWL multi-variate functions: two FPGA implementations," *International Journal of Circuit Theory and Applications*, vol. 39, pp. 1-15, 2011, doi: 10.1002/cta.610.

Circuit implementation of piecewise-linear control systems

-) A. Bemporad, A. Oliveri, T. Poggi, M. Storace, "Ultra-Fast Stabilizing Model Predictive Control via Canonical Piecewise Affine Approximations," *IEEE Transactions on Automatic Control*, vol. 56, Dec. 2011, doi: 10.1109/TAC.2011.2141410.

Circuit theory

-) M. Storace, P. Julián, M. Parodi, "Synthesis of nonlinear multiport resistors: a PWL approach," *IEEE Transactions on Circuits and Systems-I: Fundamental Theory and Applications*, vol. 49, No. 8, pp. 1138-1149, August 2002.
-) M. Storace, F. Bizzarri, M. Parodi, "Cellular non-linear networks for minimization of functionals. Part 1: Theoretical aspects," *International Journal of Circuit Theory and Applications*, vol. 29, No. 2, pp. 151-167, Mar.-Apr. 2001.

Circuit model of hysteresis

-) M. Parodi, M. Storace, S. Cincotti, "Static and dynamic hysteretic features in a PWL circuit", *International Journal of Circuit Theory and Applications*, vol. 24, No. 2, pp. 183-199, Mar.-Apr. 1996.

Research Grants

Coordinator:

- EU Grant "MOBY-DIC: Model-based synthesis of digital electronic circuits for embedded control" - 2009-2012 (FP7-INFISO-ICT-248858). Project coordinator of a research network with Università degli Studi di Genova, Technische Universiteit Eindhoven, Universidad de Sevilla, Università degli Studi di Trento, FORD Forschungszentrum Aachen GMBH, ON Semiconductor Belgium BVBA. Total value EUR 2.140.000. Genoa's share approx EUR 456.000.
- Italian Ministry of University and Research Grant (approx EUR 113.000) - 2006-2008 (PRIN2006). National coordinator of a research network with the Universities of Genoa, Turin, and Rome "Tor Vergata". Title: "Approximation of networks of nonlinear dynamical systems (models of biologically plausible neurons) and implementation of parallel circuits for their emulation"
- Italian Ministry of University and Research Grant - 2004-2006 (PRIN2004). Node coordinator (approx EUR 43.000) of a research network with the Universities of Genoa, Turin, Rome "Tor Vergata", and Bari. Title: "CNN application to real time processing of ophthalmic images as medical diagnosis support".
- Italian and Argentine Ministry for Foreign Affairs, in the framework of the bilateral agreement for scientific and technologic cooperation between Italy and Argentine 2004-2005 (Argentine coordinator: Prof. Pedro Julián, Universidad Nacional del Sur). Title: "Circuit implementations of piecewise-linear systems "
- Italian Ministry of University and Research Grant - 2003-2006 (FIRB2001). Node co-coordinator (approx EUR 250.000) of a research network with the Universities of Ferrara, Genoa, Turin, and Milan. Title: "Innovative methods for analysis and design of chaotic circuits".
- Italian National Research Council (CNR) (approx EUR 13.000) - 2001-2002, in the framework of the "Young researchers projects" initiative. Title: "Analysis, implementation and possible applications of an electronic oscillator based on hysteresis able to produce chaotic dynamics".

Investigator (projects after year 2000):

- External investigator in the European project APEREST (<http://aperest.epfl.ch/persons.htm>) "Approximately Periodic Representation of Stimuli" (IST-2001-34893) - 2003-2005. Research network with Universidad Complutense de Madrid (Madrid), École Polytechnique Fédérale de Lausanne (Losanna), Karolinska Institute (Stoccolma)).
- Italian Ministry of University and Research Grant - 2001-2003 (PRIN2001). Research network with the Universities of Genoa, Turin, Rome "Tor Vergata", and Bari. Title: "Development and testing of a real-time system, based on neural circuits and algorithms, for information extraction through stereoscopic vision in 3D environments".

International Editorial and Organizing Activities

- 2008-2009 Associate Editor of the IEEE Transactions on Circuits and Systems II
- Review Committee Member for the International Symposium on Circuits and Systems (2008-2011) in the "Nonlinear Circuits and Systems" track.

International Journals Refereeing

- IEEE Transactions on Circuits and Systems (I and II)
- International Journal of Circuit Theory and Applications
- IEEE Transactions on Neural Networks
- International Journal of Bifurcation and Chaos

- Chaos
- PhysicaD
- IEICE Transactions
- Nonlinear Analysis
- Digital Signal Processing
- Journal of Dynamic Systems Measurement and Control
- Mathematical and Computer Modelling
- Mathematical Problems in Engineering
- Computer Methods and Programs in Biomedicine
- Chinese Physics Letters
- Journal of Zhejiang University Science C

Workshops and Meetings

- Co-Chair and co-organizer of the *invited sessions* "MPC on Embedded Systems (I and II)" World Congress of the International Federation of Automatic Control (IFAC2011), 28 August – 2 September 2011 (Milan, Italy).
- Chairman and co-organizer of the *invited session* "Piecewise Linear Circuits and Systems: Bridging Electronics and Control Systems", ISCAS2010 (Paris, France).
- Invited speaker at "International Workshop on Multi-Rate Processes & Hysteresis", University College Cork, Ireland, March 31- April 5, 2008. Title: "Piecewise-linear Approximation of the Hindmarsh-Rose Neuron Model".
- Invited speaker at "International Workshop on Multi-Rate Processes & Hysteresis", University College Cork, Ireland, April 3-8, 2006. Title: "Codimension-2 Bifurcations in a Circuit Oscillator Based on Hysteresis".
- Invited speaker at "International Workshop on hysteresis & multi-scale asymptotics", University College Cork, Ireland, March 17-21, 2004. Title: "PWL approximation of nonlinear dynamical systems. Part-I: structural stability".
- Co-chairman of the *invited session* "Piecewise Linear Circuits and Systems", ISCAS2003 (Bangkok, Thailandia).
- Invited speaker at the Int. Workshop "Bifurcations in Nonsmooth Dynamical Systems", Milan, 22-23 April 2002. Title: "Bifurcation analysis of a 3D piecewise-linear continuous flow through a 1D discontinuous map: a circuit example".

Professional Societies

- *Member* of the Technical Committee on Nonlinear Circuits and Systems of the IEEE CAS Society (2006-)

Past and current PhD students and PostDocs

- *Federico Bizzarri*, completed his PhD in 2001; jointly supervised with Prof Mauro Parodi
- *Federico Bizzarri*, PostDoc on Bifurcation analysis of smooth and nonsmooth dynamical systems 2003-2008 (five years)
- *Lorenzo Repetto*, completed his PhD in 2004; jointly supervised with Prof Mauro Parodi
- *Daniele Stellardo*, completed his PhD in 2006
- *Daniele Stellardo*, PostDoc on Identification of the connectivity in networks of biological neurons 2007-2008 (one year)
- *Tomaso Poggi* completed his PhD in 2009
- *Tomaso Poggi*, PostDoc on Digital circuit implementation of PWA functions in embedded control systems 2010 (one year)
- *Daniele Linaro*, completed his PhD in 2010
- *Alberto Oliveri*, started his PhD in January 2010
- *Matteo Biggio*, started his PhD in January 2011

Current Teaching

- From 2003, "Analysis of nonlinear dynamical systems", PhD in Electrical Engineering (20 h.). Course offered to the PhD students of the Faculty of Engineering and taught in English
- From 2010, "Nonlinear dynamics and signal processing" (M.Sc. Degrees in Electronic Engineering and in Telecommunications Engineering)
- From 2009, "Dynamical Systems and Neuron Models" (M.Sc. Degree in Biomedical Engineering)
- From 2009, "Basic circuit theory" (B.Sc. Degrees in Electronics, Biomedical Engineering, and Telecommunications Engineering)

Past Teaching

- 2004-2009, "Circuits and algorithms for signal processing" (M.Sc. Degree in Electronic Engineering)
- 2003-2009, "Circuits and systems for signal processing" (M.Sc. Degree in Telecommunications Engineering)
- 2003-2009, "Linear circuits" (B.Sc. Degree in Electronic Engineering)
- 2001-2009, "Basic circuit theory" (B.Sc. Degree in Telecommunications Engineering)
- 1999-2001, "Electrical networks theory" (5-year Degree in Electronic Engineering)
- 2001-2003, "Basic circuit theory" (B.Sc. Degrees in Electronics, Computer Science and Telecommunications Engineering *at the Polytechnic of Milan*)