Curriculum
of teaching and scientific activity

Federico Fontana

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Contents

1 Personal data

Name	Federico Fontana
birth place	Pordenone
date of birth	May 28, 1969
address	Porcia (PN), via Villa Scura 28
e-mail	federico.fontana@univr.it
Position	Assistant professor at the Faculty of Sciences of the University of Udine - Italy (since 2009)
PhD	in Computer Science, Department of Computer Science of the University of Verona - Italy (2003)
Degree	in Electronic Engineering, Department of Information Engineering of the University of Padua - Italy (1996)

2 Employment record

2005-2009	Assistant professor at the Department of Computer Science of the University of Verona, strada Le Grazie 15, 37134 Verona (Italy).
2004-2005	Post-doc researcher at the Department of Computer Science of the University of Verona, strada Le Grazie 15, 37134 Verona (Italy).
2003	Post-doc researcher at the Department of Information Engineering of the University of Padua, via Gradenigo 6, Padua (Italy).
2000-2002	Ph.D. student in Computer science at the Department of Computer Science of the University of Verona, strada Le Grazie 15, 37134 Verona (Italy).
1998-2003	Independent R&D consultant. Research grants from the Department of Information Engineering of the University of Padua, via Gradenigo 6, Padua (Italy).
1996	Engineer at UH S.A. (Barcelona, Spain).

3 Affiliations

- IEEE member
- ACM member
- AIMI (Associazione Informatica Musicale Italiana) member

4 Research interests

A short synopsis of the present and past *research interests* is provided, along with pointers to related publications.

- (present) *Sound and Music computing* [5, 6, 9, 10, 15, 18, 37, 40, 44, 36, 16, 17, 34, 53, 61, 19, 58, 59] deals with the analysis, synthesis, manipulation and evaluation of audio and musical information. This field is constantly vitalized by the modeling and design of interactive systems for applications of multi-modal (especially auditory and tactile) augmented reality, in which real-time feedback control is instantaneously and continuously informed by users' gestures, manipulation, intentions, and even affective characters. In this context, the design of non

visual displays capable of supporting our tasks and seamlessly enriching the perception of our surroundings is a complex process, involving knowledge ranging across the psychology and ecology of hearing up to the user-centered, especially *Sonic interaction design* [1, 23, 24, 25, 7, 8, 28, 29, 30, 31, 32, 33, 35, 2, 41, 48, 49, 51, 56]. Products of this research activity include (both software and physical) models and prototypes of interface components, covering issues of user's data acquisition up to the acoustic and tactile rendering and evaluation of non visual information.

- (2003-2006) *Biosignal processing* [11, 12, 13, 14, 12, 11, 38, 20, 39, 42, 43]. Signal transduction networks are traditionally modeled in the continuous domain, via nonlinear differential equation systems. Alternative methodologies have been investigated as well, which work in the symbolic domain. Membrane computing is one of these alternative methodologies: by means of its generative tools, interesting observations can be made about the nature and behavior of sophisticate genomic signals such as those governing circadian cycles.

- (2000-2003) *DSP software* [3, 4] design and engineering of real-time signal processing algorithms for the synthesis, equalization and spatialization of piano sounds that were put onboard a marketed digital piano keyboard. Moreover, a digital "Dolby B" that has been patented in the EU and the US and was successfully employed in some widely marketed car radios.

5 Coordination and participation in research projects

- Coordinator of the EU Project 222107 FET-Open *NIW - Natural Interactive Walking* (2008-2011)

- Coordinator of the project *REVIVAL - Restauro dell'Archivio Vicentini di Verona e sua accessibilità come Audio e-Library*, a "Joint Project" between the University of Verona and Fondazione Arena di Verona (2008-2010)

- Coordinator of the project *E-PHASE - Electronic Piano with Haptic And Spatial Enhancements*, a "Joint Project" between the University of Verona and Viscount SpA (2008-2010)

- Local coordinator of the European Foundation for the Study of Diabetes (EFSD)-Novartis project *Genetic Bases of β-Cell Role in Glucose Homeostasis of Patients With Type 2 Diabetes: A Computational Biomedicine Study* (2008-2010).

- Local coordinator from 2008 of the EU Project FP6-NEST-29085 *CLOSED - Closing the Loop Of Sound Evaluation and Design* under the path "Measuring the impossible" (2006-2009).

- Coordinator of the project *Sound synthesis by physical models of the piano*, a "Joint Project" between the University of Verona and Viscount SpA (2007-2008).

- Team member in the national project COFIN 2004 *Symbolic models of cellular dynamics: biomolecular algorithms and membrane systems* funded by the Italian Ministry of University Research (2005-2006).

- Consultant for the EU Project IST IST-2-511316-IP *RACINE - IP* funded by the European Community in the ICT-EU research activity (2004, 2005).

- Consultant for the EU Project IST 2001-37117 *RACINE - S* funded by the European Community in the ICT-EU research activity (2003, 2004).

- Team member in the EU Project IST 2000-25287 *SOb – The Sounding Object* funded by the European Community in the IST *Future and Emerging Technologies* initiative (2001-2003).

- Team member in the national project *Augmented Reality for Teleoperation of Free Flying Robots*, funded by the Italian Space Agency (2002).

6 Teaching

- Teacher of Sound processing for the Master in *Computer Game Development* at the Dipartimento di Informatica of the University of Verona - Italy (2009).
- Teacher of Non visual interaction at the Faculty of Sciences of the University of Verona - Italy (2009).
- Teacher of Sound processing at the Faculty of Sciences of the University of Verona - Italy (2008, 2009).
- Teacher of Object-based programming at the Faculty of Sciences of the University of Verona - Italy (2006-2008).
- Teacher of Fundamentals of computer science and at the Faculty of Sciences of the University of Verona - Italy (2005-2008).
- Tutor at the Summer School in Sound and Music Computing, Casa da Musica, Porto, Portugal, July 18-21, 2009.
- Tutor of a PhD course entitled *Introduction to an environment for scientific calculation*, University of Verona - Italy (2009).
- Tutor at the Summer School in Sound and Music Computing, KTH Royal Institute of Technology, Stockholm, Sweden, July 2-6, 2007.
- Teacher of Musical informatics (laboratory) at the Faculty of Literature of the University of Udine - Italy (2005).

7 Reviewing

- Project evaluator for the Estonian Science Foundation (2008, 2010).
- Book reviewer for the Engineering technology editorial team at John Wiley, UK (2006, 2010).
- Reviewer for ACM *Transactions Applied Perception*, IEEE *Computer*, IEEE *Signal Processing Magazine*, IEEE *Transactions on Signal Processing*, IEEE *Transactions on Speech and Audio Processing*, IEEE *MultiMedia*, IEEE *Signal Processing Letters*, Elsevier *Theoretical Computer Science*, Elsevier *BioSystems*, Elsevier *International Journal of Human-Computer Studies*, Elsevier *GENE*, EURASIP *Applied Signal Processing*.
- Reviewer for the *International Conference on Digital Audio Effects* (regularly), the *International Computer Music Conference* (occasionally), the *Conference on New Interfaces for Musical Expression* (regularly), the *Information Processing and Management of Uncertainty in Knowledge-Based Systems* workshop (2006), the *International Conference on Music Information Retrieval* (2003) and the 22^{nd} Conference of the *Audio Engineering Society* (2002).
- Ph.D. thesis examiner for the Department of Electrical & Computer Engineering, McGill University (Montreal, Canada) (2009); for the Laboratory of Acoustics and Audio Signal Processing, Aalto University (Espoo, Finland) (2006).

8 Participation to conference and journal committees

- Scientific chair of the *Haptic and Auditory Interaction Design* (HAID2010) conference (Aalborg University in Copenhagen, Copenhagen, Denmark, September 2010).
- Guest Editor of an *EURASIP Journal on Advances in Signal Processing* special issue on "Musical Applications of Real-Time Signal Processing" (expected publication in 2011).
- Guest Editor of an *IEEE Transactions on Audio, Speech and Language processing* special issue on "Virtual Analog Audio Effects and Musical Instruments" (May 2010).
- Session organizer at the *Eurographics - IT* conference (Dipartimento di Informatica, University of Verona, October 2009).
- Member of the Technical Program Committee for the *HAVE 2009 IEEE International Workshop on Haptic Audio Visual Environments and Games* (2009).
- Member of the Technical Program Committee for the *International Conference on Digital Audio Effects* (2009).
- Member of the Program Committee of the *IEEE International Conference on High Performance Computing and Communications (HPCC)* (2008,2009)
- Member of the Scientific committee of the *Colloquium on Musical Informatics* (2008).
- Session Chair at the *Haptic and Auditory Interaction Design* conference (TU Dresden, Germany, September 2009).
- Session Chair at the *International Conference on Auditory Display* (IRCAM, Paris, July 2008).
- Session Chair at the *International Computer Music Conference* (Aalborg University Esbjerg, Copenhagen, August 2007).

9 Invitation to conferences, tutorials, talks

- "Nonlinear delay-free loop filter networks: the case of the voltage-controlled filter", invited talk at the *Current Trends in Music Instrument Research*, a very selective workshop on the occasion of Anders Askenfelt's 60th birthday (KTH, Stockholm, October 2009).
- Federico Avanzini and Federico Fontana, *Numerical techniques for virtual musical instruments and virtual analog audio effects*, tutorial at the *International Conference on Digital Audio Effects* (2009).
- Invited expert at the WG4 meeting of the COST SID Action IC0601 on Sonic Interaction Design (TU Berlin, Germany, April 4, 2008).
- Three lectures entitled "Delay-free nonlinear digital filter loops: Computation and examples", Helsinki University of Technology, Espoo, Finland (March 2-4, 2008). Granted with an STSM from the COST SID Action IC0601 on Sonic Interaction Design.
- Andrea Cipriani e Federico Fontana, "Gli 'strani anelli' nellopera di J.S. Bach. Un esempio di musica theoretica, tra ars e scientia", invited event at the Verona Science Festival *Infinitamente* (Verona, February 2008).
- "Making Computational Systems Biology Using Symbolic Rewriting", seminar at Tsinghua University, Beijing, 2005.

- "Formal Computation of Nonlinear Filter Networks Containing Delay-Free Loops", invited talk for the inauguration of SARC (Queen's University, Belfast, UK, 2004).

10 Tutoring

- PhD tutor of Dr. Stefano Papetti (2007-2009), Dr. Stefano Zambon (since 2008), and Dr. Federica Bressan (since 2009).
- Tutor during the research visit of Dr. Jyri Pakarinen to the Dipartimento di Informatica, University of Verona, funded by a grant of the Aalto University (May-October 2009).
- Tutor during the research visit of Dr. Heidi-Maria Lehtonen to the Dipartimento di Informatica, University of Verona, funded by a grant of the Aalto University (Spring 2008).
- Tutor of a one-month internship of Mr. Paresh Mehta to the Dipartimento di Informatica, University of Verona, locally funded (July 2007).
- Scientific responsibility of research grants assigned to: Alberto Amendola, Balazs Bank, Gianpaolo Borin, Marco Civolani, Antonio De Sena, Carlo Drioli, Pietro Polotti.
- Many graduation/master theses.

11 Organization of events

- Exhibit at the FET09 Conference *Science beyond Fiction* (Prague, Czech Rep., March 2009). The exhibit was chosen among few others for release by the BBC.
- Organization of the event entitled *La ricostruzione virtuale del pianoforte* (Dipartimento di Informatica, University of Verona, October 2008). Event released by RAI 3 Veneto and the Italian national press.
- Organization of the Italian Association of Acoustics (AIA) workshop entitled *Lo spazio acustico e l'esecuzione musicale – Interazioni e rapporti* (Conservatorio "Dall'Abaco", Verona, 2007).
- Local organization of the PhD course in *Advanced algorithms for the analysis and visualization of DNA and protein sequences* (Dipartimento di Informatica, University of Verona, July 2007).
- Local organizer of the *2nd ESF Training Course on Molecular Interactions* (Dipartimento di Biotecnologie, University of Verona, July 2007).

12 Professional activity for R&D of public and private bodies

- Consultant for STMicroelectronics – Automotive Division (Agrate Brianza, Italy) in the design and real-time realization of a digital "Dolby B" noise suppression system (1999–2000).
- Consultant for Generalmusic (San Giovanni in Marignano, Italy) in the design and real-time realization of sound processing algorithms for electronic keyboards (1999–2000).
- Consultant for Consorzio Venezia Ricerche (Venice, Italy) in the realization of an high-tide phone-call alerting system based on a server-controlled cluster of speech synthesizers (2000).
- Engineer at UH S.A. (Barcelona, Spain) working in the design and early testing of an automatic noise & vibration measurement process (1996).

13 Product achievements

- *MoogFF* module for the SuperCollider real time sound processing software environment.
- Real-time system for the simulation of the analog "Dolby B" codec (contractor: STMicroelectronic Automotive Division, A. Brianza - MI, Italy) [3, 4].
- Real-time system for the virtual rendering of binaural cues (contractor: GeneralMusic, S.G. Marignano - RN, Italy)
- Real-time system for the dynamic reconstruction of piano sounds from static samples (contractor: GeneralMusic, S.G. Marignano - RN, Italy)

References

[] **Edited books**

[1] R. Nordahl, S. Serafin, F. Fontana, and S. Brewster, eds., *Haptic and Audio Interaction Design, 5th International Workshop, HAID 2010. Proceedings*, vol. 6306 of *Lecture Notes in Computer Science*. Heidelberg, Germany: Springer, 2010. ISBN: 978-3-642-15840-7.

[2] D. Rocchesso and F. Fontana, eds., *The Sounding Object*. Florence, Italy: Edizioni di Mondo Estremo, 2003.

Patents

[3] F. Fontana and M. Bricchi. Process for noise reduction, particularly for audio systems, device and computer program product therefor. US Patent US2003004591, January 2003.

[4] M. Bricchi and F. Fontana. A process for noise reduction, particularly for audio systems, device and computer program product therefor. EU Patent EP1271772, January 2003.

Journal papers

[5] B. Bank, S. Zambon, and F. Fontana, "A modal-based real-time piano synthesizer," *IEEE Trans. on Audio, Speech and Language Processing*, vol. 18, no. 4, pp. 809–821, 2010. Special Issue on Virtual Analog Audio Effects and Musical Instruments.

[6] F. Fontana and M. Civolani, "Modeling of the EMS VCS3 voltage-controlled filter as a nonlinear filter network," *IEEE Trans. on Audio, Speech and Language Processing*, vol. 18, no. 4, pp. 760–772, 2010. Special Issue on Virtual Analog Audio Effects and Musical Instruments.

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[9] F. Fontana and F. Avanzini, "Computation of delay-free nonlinear digital filter networks. Application to chaotic circuits and intracellular signal transduction," *IEEE Trans. on Signal Processing*, vol. 56, pp. 4703–4715, Oct. 2008.

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[11] F. Fontana and V. Manca, "Predator-prey dynamics in P systems ruled by metabolic algorithm," *BioSystems*, vol. 91, no. 3, pp. 545–557, 2008.

[12] F. Fontana and V. Manca "Discrete Solution of Differential Equations by Metabolic P Systems" *Theoretical Computer Science*, vol. 372, no. 2-3, pp. 165–182, 2007.

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[14] F. Fontana and G. Franco. Finding the maximum element using P systems. *J. of Universal Computer Science*, 10(5):567–580, 2004.

[15] F. Fontana. Computation of linear filter networks containing delay-free loops, with an application to the waveguide mesh. *IEEE Trans. on Speech and Audio Processing*, 11(6):774–782, November 2003.

[16] B. Bank, F. Avanzini, G. Borin, G. D. Poli, F. Fontana, and D. Rocchesso, "Physically informed signal processing methods for piano sound synthesis: a research overview," *EURASIP J. Audio Signal Processing*, no. 10, pp. 941–952, 2003. Special issue on Digital Audio for Multimedia Communications.

[17] F. Fontana and M. Karjalainen, "A digital bandpass/bandstop complementary equalization filter with independent tuning characteristics," *IEEE Signal Processing Letters*, vol. 10, pp. 88–91, Apr. 2003.

[18] F. Fontana and D. Rocchesso, "Signal-theoretic characterization of waveguide mesh geometries for models of two-dimensional wave propagation in elastic media," *IEEE Trans. on Speech and Audio Processing*, vol. 9, pp. 152–161, Feb. 2001.

[19] F. Fontana and D. Rocchesso, "Physical modeling of membranes for percussion instruments," *Acustica*, vol. 83, pp. 529–542, Jan. 1998.

Book chapters

[20] L. Bianco, F. Fontana, G. Franco, and V. Manca, "P systems for biological dynamics," in *Applications of Membrane Computing* (G. Ciobanu, G. Păun, and M. J. Pérez-Jiménez, eds.), pp. 81–126, Springer, 2006.

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Conference proceedings

[23] S. Papetti, F. Fontana, M. Civolani, A. Berrezag, and V. Hayward, "Audio-tactile display of ground properties using interactive shoes," in *Haptic and Audio Interaction Design* (R. Nordahl, S. Serafin, F. Fontana, and S. Brewster, eds.), vol. 6306 of *Lecture Notes in Computer Science*, pp. 117–128, Springer Berlin / Heidelberg, 2010. 10.1007/978-3-642-15841-4_13.

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