

Curriculum Vitae

Name: **Paolo**

Family name: **Banelli**

Date of birth: **May 19th, 1968**

WORKING EXPERIENCE and QUALIFICATIONS

- *September 2019* Full Professor in Signal Processing and Telecommunications, Faculty of Engineering, University of Perugia, Perugia, Italy.
- *December 2013*: Scientific qualification for a Full-Professor position in signal processing and telecommunications in Italian Universities., granted by a national committee. (confirmed also in January 2015 and July 2018)
- *November 2005*: Associate Professor in Telecommunications & Signal Processing), Faculty of Engineering, University of Perugia, Perugia, Italy.
- *1997–2005*: Assistant Professor at the Dept. of Electronic and Information Engineering, University of Perugia, Perugia, Italy.
- *1993–2000*: Technical Consultant for Itelco spa, Orvieto, Italy (Broadcasting transmission techniques)

EDUCATION

- *June 1998*: “Dottorato di Ricerca (Ph.D.) in Ingegneria Elettronica” at University of Perugia, Italy, Thesis on "Non Linear Distortion analysis and predistortion in OFDM systems".
- *September 1993*: “Laurea in Ingegneria Elettronica” (Master Science in Electronics), University of Perugia, Italy.
- *July 1986*: Diploma di Maturità Scientifica (Scientific Lyceum High School Diploma) at “Liceo Scientifico G. Allessi” in Perugia, Italy.

SHORT SUMMARY OF THE RESEARCH ACTIVITY

My research activity focused for several years on the analysis and compensation of non-linear distortions in telecommunication systems. Particular attention has been reserved to the sensitivity of OFDM systems to non-linear distortions introduced by high-power amplifiers, as it happens in Broadcasting (DAB, DVB-T) and WLAN (IEEE 802.11) systems. From 1995 to 2000, a significant part of this activity has been conducted in collaboration with Itelco (now Electrosys). The collaboration with Itelco led also to the realization and patenting of a Baseband and a Mixed Baseband-IF predistorter [PT2][PT3].

Around 2000, Multiuser (MU) Detection for wideband CDMA attracted my attention, with a specific interest on the sensitivity of MMSE blind multiuser detectors to channel and correlation-matrices estimation errors, and on the theoretical performance analysis of MU-CDMA systems in non-linear fading channels. [R26][R25][R24][R23]

Since 2001, after a 6-months visiting at ECE Department of University of Minnesota (Prof. G. B. Giannakis), my research interests mainly focused on block-transmission techniques and the associated signal processing for wireless communication systems (e.g., OFDM, Multicarrier-CDMA, etc.).



Specifically, I have been working on the performance degradation induced by carrier-frequency-offset (CFO) at the receiver side [R21], on linear-precoding techniques with local maximum likelihood reception [R20], channel estimation and equalization.

Starting from 2004-2005, the research on wireless block-transmission techniques mainly focused on channel estimation and low complexity equalization in time-varying frequency-selective fading channels, in multipath scenarios with high Doppler spreads [R19][R18][R17][R16][C28][C30]. This research topic has been also the opportunity to strength the scientific collaboration, started in 2001, with Prof. G. Leus, Technical University of Delft, Delft, the Netherlands. In this framework, the analysis started from single-antenna OFDM systems with classical linear equalization, it has been extended to fast time-varying channels in MIMO systems, as well as to iterative and turbo equalization approaches [C19]. In the last few years, although my research interest partially moved to other topics that I will detail below, I have been still active on signal waveform design for 5G communications, and beyond [R9].

The broad research expertise on OFDM and Multicarrier Signal Processing, received the appreciation of the international research community, as testified by the quite significant number of citations received by the papers published on this subject. Furthermore, I have been invited to contribute with a chapter to the Academic Press Library in Signal Processing, an e-encyclopedia launched by Elsevier [B4], edited Prof. R. Chellappa (Univ. of Maryland, USA) and Prof. S. Theodoridis (Univ. of Athens, Greece), with two chapters [B1] [B6] to a book edited by Prof. F. Hlawatsch, and Prof. G. Matz (Wien University of Technology, Austria), which collected an outstanding pool of researchers.

The wide expertise on this subject facilitated also technical collaboration with private companies, and I was the scientific coordinator of research projects funded by Magneti-Marelli Motorsport (IT) [P14], Frontier Silicon (UK)/Silansys Technologies (EIRE) [P9], Electrosys (IT) [P10], and more recently by Xibo (IT) [P4][P5].

In 2007-2008, the participation as a member of CNIT (National Interuniversity Consortium for Telecommunications) to SatNex II (FP6 Network of Excellence) was the opportunity to focus the attention to data-link and physical cross-layer designs. The goal was to boost the throughput of satellite links under prescribed BER performance constraints. In this context, it has been proposed a new scheduling policy for systems that exploit data-link ARQ protocols and Adaptive Modulation and Coding (AMC) at the physical layer. Furthermore, it has been proposed a general framework to establish the theoretical delay, throughput, and packet-loss rate performance of those scheduling policies that take into account of the buffer occupancy and of the number of retransmissions by ARQ [R14].

Between 2006 and 2012 I supervised some laboratory experimentation, in the field of bio-medical engineering. Specifically, since 2006 with a small research group of MS students and a couple of PhD students, we focused on the design and implementation of a portable ECG device, and of an ultrasound echo-graphic laboratory test-bed. Signal processing and identification algorithms have been designed and implemented on this hardware, to assist medical diagnosis. Furthermore, some scientific contributions have been published in the fields of ultrasound coded-excitation medical imaging [C17][R13], pacemaker detection on ECG tracks [C22], and ECG tracks compression [C21] (in collaboration with Prof. M. G. Martini, Kingston University, London, UK).

TB

The bio-medical activity led in 2010 to run a University Spin-Off (ICT4Life srl) founded together with 3 university colleagues and 5 Ph.D. students. The mission of ICT4Life was to apply ICT technologies to improve the quality of "Life", in a broad extent, including eHealth applications. Between 2010 and 2013 I was the scientific co-director and vice-president of ICT4Life, whose activity spans instrumentations and algorithms for medical applications, medical information systems and telemedicine, system biology, as well as genomic and proteomics. In 2015, together with all the other academic colleagues, we left ICT4Life, which is still active.



From 2013 my research efforts were directed mostly to (collaborative) spectrum sensing policies for cognitive radios [R12] [C15] [C12] [C11], detection on impulsive noise environments [R11][R5], and general theoretical insights on the link between estimation theory, channels capacity and non-linear distortions under non-Gaussian noise statistics [R8].

Since 2015, my research interests have been attracted by signal processing on graphs, coupled with adaptive and distributed signal processing and optimization. Signal processing on graphs is a rather new theoretical subject, which is rapidly emerging in the technical literature, and in the networks science, which is capable to model (Big-) data on a more general non-metric space (i.e., a graph), with respect to classical discrete signal processing. In this framework, I am interested in sparse signal representations, sampling and reconstruction, distributed and adaptive statistical inference, as well as network inference.

Applications may vary from (statistical) brain signal analysis, monitoring and control, to sensor and telecommunication networks, social networks analysis, vehicular and power-grid networks, as well as gene-regulatory networks [R1] [R6] [R7] [R7]. This research topic is developed in collaboration with Dr. P. Di Lorenzo, and Prof. S. Barbarossa from University of Rome "La Sapienza", and more recently, with Prof. G. Leus from University of Delft, in the Netherlands. Recently, I was also invited to co-author a chapter on a book edited by Prof. P. M. Djuric (Stony Brook University, Long Island, NY) and Prof. C. Richard (Univ. of Nice Sophia-Antipolis, France), which collected an outstanding pool of researcher [B1].

August 2019, July 2020 I have been a Visiting Professor at Stony Brook University, NY, USA, where I established a research collaboration with Prof. Petar Djuric, on subjects related to brain-networks signal analysis and learning.

At the end of this document, there is detailed list of technical manuscripts I have published on these subjects. The good quality of this scientific production is testified by the quite high number of citations received throughout my entire carrier, both from theoretical papers, and more application-oriented ones.

TECHNICAL & SCIENTIFIC ACTIVITIES

- *January 2020, present* Associate Editor for the IEEE Open Journal on Signal Processing.
- *Jan 2013-Dec. 2016*, Associate Editor for the IEEE Transaction on Signal Processing (2+2 years term).
- *October 2012-present*, Associate Editor for the EURASIP Journal on Advances in Signal Processing, Springer Ed.

- 2011-2014 (3 years term), Elected by international colleagues as a member of the Signal Processing for Communications and Networking Technical Committee (SPCOM-TC) of the IEEE Signal Processing Society.
- 2011-2013 (3 years term), Member of the Scientific Committee at CNIT, National Inter-University Consortium for Telecommunications, as representative of the CNIT Research Unit in Perugia.
- 2009, General Co-Chair for IEEE SPAWC 2009, Int. Workshop on Signal Processing Advances for Wireless Communications, Perugia, Italy, June 2009.
- 2019-2020, Tutorial Co-Chair, for EUIPCO 2020, European Signal Processing Conference, Amsterdam, The Netherlands, September 2020.
- 2018, Track Chair for Eurasp EUSIPCO 2018, European Signal Processing Conference, Rome, Italy, September 2018.
- 2012, 2014 TPC-Member for IEEE ICASSP, Int. Conf. on Acoustics, Speech and Signal Processing.
- 2009, 2011, 2012, 2013 TPC-Member for IEEE SPAWC, Int. Workshop on Signal Processing Advances for Wireless Communications (10-15 reviews each year).
- 2004, 2005, 2007, 2008, 2010, 2013 TPC Associate-Reviewer for IEEE ICASSP, Int. Conf. on Acoustics, Speech and Signal Processing, (8-10 reviews each year).
- 2010, TPC Associate-Reviewer for SPAWC 2010, Int. Workshop on Signal Processing Advances for Wireless Communications.
- 2005, 2007, 2008, TPC-Member for IEEE ICC' Int. Conference on Communications.
- 2008, Member of the Scientific Committee for the annual meeting of the Italian Group for Telecommunications and Information Technology (GTI), Firenze.
- 2006, TPC-Member for IEEE ISSPIT, Int. Symposium on Signal Processing and Information Technology.
- 2006, 2007, TPC-Member for IEEE Globecom, Satellite and Space Comm. Symposium.
- 2006, 2008, 2013, 2017 TPC-Member for EURASIP EUSIPCO, European Signal Processing Conference.
- Member of commissions to assign Italian Research Assistant positions: Univ. of Napoli "Federico II" (2003), Univ. of Padova (2005).
- Member of commissions for Italian Ph.D. final exam: Univ. of Perugia (2009), Univ. of Padova (2010), Univ. of Pisa (2012), Univ. of Roma "La Sapienza" (2013), Polytechnic University of Marche (2016).

- **REVIEWER for the following International Journals**

- o IEEE Transactions on Signal Processing
- o IEEE Transactions on Wireless Communications.
- o IEEE Transactions on Communications.
- o IEEE Transactions on Information Theory.

- o IEEE Transactions on Vehicular Technology.
- o IEEE Transactions on Instrumentations and Measurements.
- o IEEE Signal Processing Letters.
- o IEEE Communications Letters.
- o European Transactions on Communications (Wiley).
- o EURASIP Signal Processing Journal (Elsevier).
- o EURASIP Journal on Applied Signal Processing (Hindawi/Springer).
- o EURASIP Journal on Wireless Commun. and Networking (Hindawi).
- o Electronic and Telecomm. Research Institute Journal (ETRI).

FUNDS RAISING & RESEARCH PROJECTS COORDINATION

PB

- [P1] *2020-2022*, Local scientific coordinator of the Perugia Research Unit, within the national call PRIN 2017, of the research project “Liquid edge computing based on distributed machine learning and millimeter-wave radio access”, national coordinator Prof. S. Barbarossa. (113 k€)
- [P2] *2015-2017*, local scientific coordinator for research and innovation support on the project «New Burn-In System for semiconductors and integrated modules”, MISE call for Funds for Sustainable Growth of H2020 objectives, D.M. 20 June 2013, Project n. F/0106/01-02/X26 - prime contractor EDA INDUSTRIES S.P.A. (28 k€).
- [P3] *2016*, scientific coordinator of "DVB-T software radio transmitter eXtension for IRIS (DVB-TX-IRIS)", 1st Open Call of the European Research Project H2020 "WiSHFUL - Wireless Software and Hardware platforms for Flexible and Unified radio and network control" (H2020 GA No. 645274), (56 k€)
- [P4] *2014*, scientific coordinator of the consulting project for Xibo s.r.l., "Underwater Acoustic Modem", (10 k€)
- [P5] *August-September 2013*, scientific coordinator of the consulting project for Xibo s.r.l., "Preliminary study for an Underwater Acoustic Modem" (2 k€)
- [P6] *2009-2010*, local scientific coordinator of the project "Diagnostic Robots: new systems based on autonomous mobile robots for diagnosis and test in production-lines and life-cycle laboratories", co-funded by Regione Marche and AEA (Loccioni Group) on the call POR-FESR 2006-2013 (30 k€)
- [P7] *2008*, scientific coordinator of the project "Industrialization of a portable ECG system" co-funded by Regione Umbria and private companies on the call POR-FESR SISTEMA 2007 (70 k€).
- [P8] *2008*, Italian scientific coordinator of a collaboration project with Kingston University, London on "Reconfigurable Healthcare for Intelligent Cardio Vascular Disease Monitoring and Management", British Council-Italian CRUI Partnership Program for Young Researchers 2007-2008 (5 k€).
- [P9] *2007*, scientific coordinator of a consulting project for Frontier Silicon, Dublin, Ireland, on "Channel estimation and equalization for DVB-T/H system in high mobility" (23 k€).
- [P10] *2007*, scientific coordinator of a consulting project for Electrosys, Orvieto, on "Echo cancellers for DVB-T/H Gap Fillers" (20 k€).

- [P11] 2006-2008, scientific coordinator of a regional co-funded project within the 2005 call of Fondazione Cassa di Risparmio di Perugia, on "Realization of a PC-based laboratory platform to develop innovative eco-graphic systems for medical applications" (50 k€).
- [P12] 2006, scientific coordinator of a regional co-funded project within the 2005 call of Fondazione Cassa di Risparmio di Perugia, on "Prototyping and pre-industrialization of an ECG system" (21 k€).
- [P13] 2006-2009 CNIT local scientific responsible for "Channel estimation and equalization for mobile satellite communications" within SatNex II, FP6 Network of Excellence, European Union (21 k€).
- [P14] 2005-2006, scientific coordinator of a consulting project for Magneti Marelli Holding Motorsport, on "Study and simulation of a telemetry system for racing competitions" (30 k€).
- [P15] 2003-2004 local scientific coordinator within the national call PRIN 2002, on "MC-CDMA: a radio interface for 4th generation radio mobile systems," national coordinator: Prof. S. Pupolin. (43k€)

AWARDS

1st classified with ICT4Life srl (Scientific Co-Director and Vice-President) to Umbria-Marche StartCup 2010 competition for business-plan ideas generated by university research, Perugia, Italy, October 2010 (prize ~ 10 k€)

INTERNATIONAL EXCHANGES AND COLLABORATIONS

-August 2019-July 2020present Visiting Professor with the group coordinated by Prof. Petar Djuric, ECE Department, University of Stony Brook, Stony Brook, NY, USA.

- 2001 (6 months): Visiting Assistant Professor at the SpinComm research group, coordinated by Prof. Georgios B. Giannakis, ECE Department, University of Minnesota, Minneapolis, MN, USA.

- 2001-2005: scientific collaboration with Prof. Georgios B. Giannakis, ECE Department, University of Minnesota, Minneapolis, MN, USA.

- 2001-present: scientific collaboration with Prof. Geert Leus, Delft University of Technology (DUT), Dept. EEMC, 2628CD Delft, the Netherlands.

- 2010-2014: scientific collaboration with Doct. H. Suraweera, Singapore University of Technology and Design, Singapore.

- 2008-2009: scientific collaboration with Prof. M. G. Martini, Kingston University, Faculty of Science, Engineering and Computing, London, UK.

- 2007-2009: scientific collaboration with Doct. Matteo Berioli, DLR German Aerospace Center, Institute of Communications and Navigation, Oberpfaffenhofen-Wessling, Germany.

- 2016-present: scientific collaboration with Prof. Sergio Barbarossa, University of Rome "La Sapienza", Roma, Italy.

- 2000-2006: Local Coordinator of the Erasmus student exchange program with European Institute of Higher Education Brussels (EHSAL), Belgium.

- *2003-present*: Local Coordinator of the Erasmus, Erasmus+ student exchange program with EEMC Department, Delft University of Technology, Delft, the Netherlands.

- **International Ph.D. Defense Committees**

- Ph.D. defense of E. Isufi, “Signal Processing on Graphs”, TU Delft, Dept. EEMCS, January 28th, 2019.

- Ph.D. defense of K. Fang, “Wireless communication over dispersive channels”, TU Delft, Dept. EEMCS, March, 1st, 2009.

- Ph.D. defense of Z. Tang, “OFDM transmission over rapidly changing channels”, TU Delft, Dept. EEMCS, November, 20th, 2007.

- **Invited Talks & Seminars**

- OFDM in Time-Varying Channels: Equalization Challenges and Solutions, Forschungszentrum Telekommunikation Wien (FTW), June 1st, 2007.

- Coded-Excitation for Ultrasound Echography, EEMCS Department, Delft University of Technology, Delft, The Netherlands, March 1st, 2010



TEACHING ACTIVITY

- *1998-2000*: Teaching Assistant in the “Teoria dei Segnali” course for the Laurea Degree (BS+MS) in Electronics and Telecommunications at University of Perugia, Italy.

- *1998-2000*: Teaching Assistant in the “Sistemi di Telecomunicazione” course for the Laurea Degree (BS+MS) in Electronics and Telecommunications at University of Perugia, Italy.

- *A.A.1998/99- A.A. 2006/07*: Teacher of the “Elaborazione Analogica dei Segnali” class for the Laurea (BS) Degree in Computer Science and Telecommunic., Orvieto, University of Perugia, Italy, (45 hours/year).

- *A.A. 2001/02 - A.A. 2002/03 and A.A. 2006/07*: Teacher of the “Teoria dei Fenomeni Aleatori” course for the Laurea Degree (BS) in Computer Science and Telecommunications, Orvieto, University of Perugia, Italy (27 hours/year).

- *A.A. 2005/06*: Teacher of the module “Tecniche di Simulazione” within the II level Master in 2G-3G Telecommunication Systems at University of Perugia, Italy (20 hours/year).

- *A.A.2001/02-A.A.2007/08*: Teacher of the “Elaborazione Analogica dei Segnali” course for the Laurea Degree (BS) in Electronics and Telecommunications at University of Perugia, Italy. (45 hours/year).

- *A.A. 2009/10*: Teacher of the “Metodi probabilistici e statistici per l’Ingegneria dell’Informazione” within the PhD Doctorate in Information Engineering at University of Perugia, Italy, (10 hours/year).

- *A.A. 2011/12 - A.A. 2012/13*: Teacher of the “Trasmissioni Wireless” module within the course “Metodi di Stima e Trasmissioni Wireless” for the Magister Laurea (MS) Degree in Electronics and Telecommunications at University of Perugia, Italy (48 hours/year).

- A.A. 2013/14 - A.A. 2016/17: Teacher of the “Trasmissioni Wireless” course for the Magister Laurea (MS) Degree in Electronics and Telecommunications at University of Perugia, Italy (72 hours/year).
- A.A. 2013/14 - A.A. 2018/19: Teacher of the “Signal Processing and Optimization for Big Data Analytics” course for the Magister Laurea (MS) Degree in Computer Engineering and Robotics, University of Perugia, Italy. (72 hours/year. 30 hours taught by Prof. P. Di Lorenzo in 2017/2018).
- A.A. 2016/17: Teacher of the module “Fundamentals of Stochastic Signals” within the II level (post Laurea) Master in Data Science at University of Perugia, Italy (14 hours/year).
- A.A. 2019/2020: Teacher of BS course ESE 340 “Basic Communications Theory” at Stony Brook University, NY, USA. (40 hours).
- A.A. 2019/2020: Teacher of BS course ESE 305 “Deterministic Signals and Systems” at Stony Brook University, NY, USA. (40 hours).

- Laurea Thesis advisor

Since 1998, when I started my academic career, I have been advising and mentoring perspective students towards their final Thesis at the end of their BS and MS degree. At the beginning of my career, most of the topics were on signal processing for wireless communications, while more focused on signal processing on networks in the recent years. However, part of them were also exploring different subjects, such as biomedical signal processing, underwater communications, and others. Some of the graduated students wanted to continue their research activity by applying for a Ph.D. position under my supervision, as detailed in the following section.

- PhD/Post-Doc/ RTD-A supervision

- 2001-2003, Luca Rugini, PhD Thesis “Analysis of multiuser communication systems with transmitter- and receiver-induced distortions”.
- 2004-2008, Luca Rugini, PostDoc Research Fellow (“Assegnista di Ricerca”) on “signal processing for wireless communication systems”, now Assistant Professor at University of Perugia, Italy.
- 2006 (1 year PhD candidate), Claudio Rocco Cannizzaro, now Senior Industry Consultant - Risk Practice - EMEA Professional Services, Delivery and Enablement at SAS, Zürich Area, Switzerland.
- 2006-2008, Mario Poggioni, PhD Thesis, “Advanced algorithms for performance optimization in wireless fast-fading channels”, now System Engineer at Art Group -Pischiello Centre, Tuoro sul Trasimeno (PG), Italy.
- 2007-2009, Alessandro Polpetta, PhD Thesis, “Signal Processing Algorithms for Medical Systems: Design and Implementation”, now Design Engineer at EDA Industries spa, Rieti, Italy.
- 2011, Paolo Micanti, PostDoc Research Fellow (“Assegnista di Ricerca”) on “Integration of medical diagnostic systems with wireless sensors and

PB

communications systems”, now Senior Software Engineer at Bloomberg LP, Switzerland.

- 2015-2018, Elvin Isufi, together with Prof. G. Leus, Delft University of Technology, The Netherlands, Ph.D Thesis “Graph-time Signal Processing: filtering and sampling strategies”, recently visiting scholar with Prof. A. Ribeiro at Pennsylvania University at Chicago, IL, USA.

- 2014-2017, Ph.D. student Loris Cannelli, together with Prof. G. Scutari, Purdue University, West Lafayette, IL, (USA), on “Parallel Non Convex Optimization algorithms with applications to MRI reconstruction”, still in Purdue.

- 2015-2017, Reference faculty-member for the Scientific research project “Distributed Optimization and Learning Over Complex Networks” associated with the temporary assistant professor position (RTD-A) granted to Ph.D. Paolo Di Lorenzo, now tenure-track Assistant Professor at University of “Roma La Sapienza”

OTHER DUTIES

- April 2015-present: Deputy of the Department Head to “Orientamento” activities for all the Laurea degrees offered by the Engineering Department. These activities included:

- Constitution and coordination of a department team for Orientamento, including also technical staff to be trained.
- Coordination and participation to “Orientamento” events organized both by the Ateneum in several cities in the neighborhoods, as well as Department information days.
- Coordinating (and participating to some) “Orientamento>” events in single schools of the neighbor territory.
- Design and populating a dedicate home page for “Orientamento” activities <http://orienta.ing.unipg.it>.
- Set-up & initial maintenance of Social media platforms for “Orientamento” purposes (Facebook, Instagram, Twitter, LinkedIn)
- Set-up and initial maintenance of Google Analytics and Pixel accounts to coordinate advertisement on Social Media platforms as well as to monitor their effectiveness.

- 2014-present, Delegate member for Associate Professors within the Board (“Giunta”) of the Department Council.

- 2014-present, Member of the Department Research Committee.

- 2013-2016 (3 years term), Member of the Directive Committee at CNIT, National Inter-University Consortium for Telecommunications, as a Deputy of the Dean of the University of Perugia.



IMPACT of the PUBLICATION ACTIVITY

The overall research activity has received a significant acknowledgement by the international research community as testified by the quite high number of citations reported in public dataset, such as Elsevier SCOPUS, Google Scholar and ISI Web of knowledge.

For instance, according to the **SCOPUS** data set, at the present date, the published manuscripts have received **2106 citations** and the author has a personal **h-index** equal to **19**.

LIST OF PUBLICATIONS

My publications list is also accessible by Google-scholar at the link
<http://scholar.google.com/citations?user=ohPQsLMAAAAAJ&hl=en>

- Book Chapters

- [B1] P. Banelli, G. Colavolpe, L. Rugini and A. Ugolini, "Waveform design," on Information Theoretic Perspectives on 5G Systems and Beyond, Eds., I. Marić, S. Shamai, O. Simeone, October 2020.
- [B2] P. Banelli, G. Baruffa, S. Buzzi, G. Colavolpe, T. Foggi, L. Rugini, A. Ugolini, "Modulations with Low Peak-to-Average Power Ratio," Wiley 5G Ref: The Essential 5G Reference Online, 1-20, 2019.
- [B3] P. Di Lorenzo, S. Barbarossa, and P. Banelli, Sampling and Recovery of Graph Signals, Cooperative and Graph Signal Processing, Chapter II.2, P. Djuric and C. Richard Eds., Elsevier, 2018.
- [B4] P. Banelli, L. Rugini, "OFDM and MC Signal Processing", Chapter 5 of Vol. 2 of Academic Press Library in Signal Processing, eds. R. Chellappa and S. Theodoridis, Academic Press, October 2013.
- [B5] L. Rugini, P. Banelli, and Geert Leus "OFDM Communications over Time-Varying Channels", Chapter 7 of Wireless Communications Over Rapidly Time-Varying Channels, Franz Hlawatsch and Gerald Matz Ed., Elsevier Academic Press, 2011
- [B6] Z. Tang, G. Leus, and P. Banelli, "Time-Varying Channel Estimation - A Block Approach," Chapter 3 of Wireless Communications Over Rapidly Time-Varying Channels, Franz Hlawatsch and Gerald Matz Ed., Elsevier Academic Press, 2011
http://www.elsevier.com/ups/find/bookdescription.cws_home/714571/description

- International Journals

- [R1] E. Isufi, P. Banelli, P. Di Lorenzo, G. Leus, "Observing and tracking bandlimited graph processes from sampled measurements," Signal Processing, pp. 107749, Aug. 2020.
- [R2] Alimenti F., et. al, "K/ka-band very high data-rate receivers: A viable solution for future moon exploration, Electronics, vol. 8, n. 3, article n. 349, March 2019.
- [R3] P. Di Lorenzo, P. Banelli, E. Isufi, S. Barbarossa, G. Leus, "Adaptive Graph Signal Processing: Algorithms and Optimal Sampling Strategies," IEEE Trans. on Signal Processing, vol. 66, n.10, pp. 3584-3598, July 2018.
- [R4] G. Baruffa, L. Rugini, F. Frescura, P. Banelli, "Real-Time Generation of Standard-Compliant DVB-T Signals," Radioengineering, vol. 27, n. 2, pp. 475-484, June 2018.
- [R5] N. Rozic, P. Banelli, D. Begusic, J. Radic, "Multiple-Threshold Estimators for Impulsive Noise Suppression in Multicarrier Communications," IEEE Trans. on Signal Processing, vol. 66, n. 6, pp. 1619-1633, March 2018.
- [R6] P. Di Lorenzo, P. Banelli, S. Barbarossa, S. Sardellitti, "Distributed Adaptive Learning of Graph Signals", IEEE Trans. on Signal Processing, vol. 65, n. 16, pp. 4193-4208, Aug. 2017.
- [R7] P. Di Lorenzo, S. Barbarossa, P. Banelli, S. Sardellitti, "Adaptive Least Mean Squares Estimation of Graph Signals", IEEE Trans. on Signal and Inf. Processing, vol. 2, n.4, pp 555-568, Dec. 2016.

- [R8] L. Rugini, P. Banelli, "On the Equivalence of Maximum SNR and MMSE Estimation: Applications to Additive Non-Gaussian Channels and Quantized Observations," *IEEE Trans. on Signal Processing*, vol. 64, n. 23, Dec. 2016.
- [R9] P. Banelli, S. Buzzi, G. Colavolpe, A. Modenini, F. Rusek, and A. Ugolini, "Modulation Formats and Waveforms for the Physical Layer of 5G Wireless Networks: who will be the heir of OFDM ?," *IEEE Signal Processing Magazine*, vol. 31, n. 6., pp. 80-93, October 2014.
- [R10] G. Baruffa, L. Rugini, and P. Banelli, "Design and validation of a software defined radio testbed for DVB-T transmission," *Radioengineering*, vol. 23, n. 1, pp. 387-398, Apr. 2014.
- [R11] P. Banelli, "Bayesian Estimation of a Gaussian source in Middleton's Class-A Impulsive Noise," *IEEE Signal Proc. Letters*, vol. 20, n. 10, pp. 956-959, October 2013.
- [R12] L. Rugini, P. Banelli, G. Leus, "Small Sample Size Performance of the Energy Detector", *IEEE Commun. Lett.*, vol. 17, n. 9, pp. 1814-1817, Sept. 2013.
- [R13] A. Polpetta, P. Banelli, "Design and Performance Evaluation of Huffman Sequences for Medical Ultrasound Coding Excitation", *IEEE Trans. on Ultras. Ferroel. & Freq. Control*, vol. 59, n.4, pp. 630 - 647, April 2012.
- [R14] M. Poggioni, L. Rugini, P. Banelli, "QoS Analysis of a Scheduling Policy for Heterogeneous Users Employing AMC Jointly with ARQ," *IEEE Trans. on Communications*, vol. 58, n.9, pp. 2639 - 2652, Sept. 2010.
- [R15] L. Rugini, P. Banelli, "Probability of Error of Linearly Modulated Signals with Gaussian Cochannel Interference in Maximally Correlated Rayleigh Fading Channels," *EURASIP Jour. on Wireless Comm. and Networking*, Volume 2010, Article ID 193183, Sept. 2010.
- [R16] M. Poggioni, L. Rugini, P. Banelli, "DVB-T/H and T-DMB: Performance Comparison in Mobile Channels," *IEEE Trans. on Broadcasting*, vol. 55, n.4, pp. 719-730, Dec. 2009.
- [R17] M. Poggioni, L. Rugini, P. Banelli, "A Novel Simulation Model for Coded OFDM in Doppler Scenarios," *IEEE Trans. on Vehicular Technology*, vol. 57, n.5, pp. 2969-2980, Sept. 2008.
- [R18] Z. Tang, R. C. Cannizzaro, G. Leus, P. Banelli "Pilot-Assisted Time-Varying Channel Estimation for OFDM Systems," *IEEE Trans. on Signal Processing*, vol. 55, n.5, pp. 2226-2238, May 2007.
- [R19] L. Rugini, P. Banelli, G. Leus, "Low-Complexity Banded Equalizers for OFDM Systems in Doppler Spread Channels," *EURASIP Journal on Applied Signal Processing*, special issue on "Reliable Communications over Rapidly Time-Varying Channels", vol. 2006, Article ID 67404, 13 pages, 2006.
- [R20] L. Rugini, P. Banelli, G. B. Giannakis, "Local ML Detection for Multicarrier DS-CDMA Downlink Systems with Grouped Linear Precoding", *IEEE Trans. on Wireless Communications*, vol. 5, n.2, pp. 306-311, Feb. 2006.
- [R21] L. Rugini, P. Banelli, "BER of OFDM Systems Impaired by Carrier Frequency Offset in Multipath Fading Channels", *IEEE Trans. on Wireless Communications*, vol. 4, n. 5, pp. 2279-2288, Sept. 2005.
- [R22] L. Rugini, P. Banelli, G. Leus, "Simple Equalization of Time-Varying Channels for OFDM," *IEEE Communications Letters*, vol. 9, n.7, pp. 619-621, July 2005.
- [R23] L. Rugini, P. Banelli, S. Cacopardi, "A Full-Rank Regularization Technique for MMSE Detection in Multiuser CDMA Systems", *IEEE Communications Letters*, vol. 9, n.1, pp. 34-36, Jan. 2005.
- [R24] L. Rugini, P. Banelli, "Joint Impact of Frequency Synchronization Errors and Intermodulation Distortion on the Performance of Multicarrier DS-CDMA Systems", *EURASIP Journal on Applied Signal Processing*, vol. 2005, n.5, pp. 730-742, April 2005.
- [R25] L. Rugini, P. Banelli, S. Cacopardi, "SER Performance of Linear Multiuser Detectors for DS-CDMA Downlink with Transmitter Nonlinear Distortions", *IEEE Trans. on Vehicular Technology*, vol. 53, n.4, pp. 992-1000, July 2004.

- [R26] L. Rugini, P. Banelli, S. Cacopardi, "Theoretical Analysis and Performance of the Decorrelating Detector for DS-CDMA Signals in Nonlinear Channels", IEEE Trans. on Wireless Commun., vol. 3, n.2, pp. 367- 372, March 2004.
- [R27] P. Banelli, "Theoretical analysis and performance of OFDM signals in nonlinear fading channels", IEEE Trans. on Wireless Communications, vol. 2, n.2, pp. 284 – 293, March 2003.
- [R28] P. Banelli, G. Baruffa, S. Cacopardi, "Effects of HPA Non-Linearity on Frequency Multiplexed OFDM Signals", IEEE Trans. on Broadcasting, vol. 47, n.2, pp. 123-136, June 2001.
- [R29] P. Banelli, G. Baruffa, "Mixed BB-IF Predistortion of OFDM Signals Non-Linear Channels", IEEE Trans. on Broadcasting, vol. 47, n.2, pp. 137-146, June 2001.
- [R30] P. Banelli, S. Cacopardi, "Theoretical analysis and performance of OFDM signals in nonlinear AWGN channels", IEEE Trans. on Communications, vol. 48, n.3, pp. 430-441, March 2000.
- [R31] S. Andreoli, P. Banelli, S. Cacopardi, H. G. McClure, "Digital Linearizer for RF Amplifiers", IEEE Trans. on Broadcasting, vol. 43, n.1, pp. 12-19, March 1997.

PB

- Conference Proceedings

- [C1] P. Di Lorenzo, C. Battiloro, P. Banelli, and S. Barbarossa, "Dynamic Resource Optimization for Decentralized Signal Estimation in Energy Harvesting Wireless Sensor Networks," IEEE Int. Conference on Acoustic, Speech, and Signal Processing (ICASSP), Brighton, UK, May 2019.
- [C2] E. Isufi, P. Banelli, P. Di Lorenzo, G. Leus, "Observing Bandlimited Graph Processes from Subsampled Measurements' Asilomar Conference on Signals, Systems, and Computers 2018, Pacific Grove, CA, October 2018.
- [C3] P. Di Lorenzo, S. Barbarossa, and P. Banelli, Optimal Power and Bit Allocation for Graph Signal Interpolation, IEEE Int. Conference on Acoustic, Speech, and Signal Processing (ICASSP), Calgary, Canada, April 2018.
- [C4] P. Di Lorenzo, P. Banelli, S. Barbarossa, "Optimal sampling strategies for adaptive learning of graph signals," European Signal Proc. Conference, EUSPICO 2017, Kos, August- Sept. 2017.
- [C5] P. Di Lorenzo, E. Isufi, P. Banelli, S. Barbarossa, G. Leus, "Distributed recursive least squares strategies for adaptive reconstruction of graph signals," European Signal Proc. Conf., EUSPICO 2017, Kos, Aug-Sept 2017.
- [C6] P. Di Lorenzo, P. Banelli, S. Barbarossa, S. Sardellitti, "Distributed Adaptive Learning of Signals Defined over Graphs," Asilomar Conference on Signals, Systems, and Computers Website, Pacific Grove, CA, USA, Nov. 2016.
- [C7] E. Isufi, G. Leus, P. Banelli, "2-Dimensional Finite Impulse Response Graph-Temporal Filters," IEEE Global Conference on Signal and Information Processing (GlobalSIP), Washington DC, USA, IEEE, Dec. 2016.
- [C8] P. Di Lorenzo, S. Barbarossa, P. Banelli, S. Sardellitti, "LMS Estimation of Signals defined over Graphs", European Signal Proc. Conference, EUSPICO 2016, Budapest, August- Sept. 2016.
- [C9] L. Rugini, P. Banelli, G. Leus, "Spectrum Sensing Using Energy Detectors with Performance Computation Capabilities", European Signal Proc. Conference, EUSPICO 2016, Budapest, August- Sept. 2016.
- [C10] P. Banelli, L. Rugini, "Impulsive Noise Mitigation for Wireless OFDM," (University of Perugia, Italy), Proc. of IEEE SPAWC 2015, pp. 346-350, Stoccolm, Sweden, 28 June-1 July 2015.
- [C11] M. Guerrini, L. Rugini, and P. Banelli, "A non-periodic sensing strategy for improved throughput in cognitive radio networks," IEEE Int. Conf. Acoustics, Speech and Signal Processing (ICASSP 2014), Florence, Italy, pp. 7288-7292, May 4-9, 2014.
- [C12] M. Guerrini, L. Rugini, P. Banelli, "Sensing-Throughput Tradeoff for Cognitive Radios", Proc. of IEEE SPAWC 2013, pp. 115-119, Darmstadt, Germany, 16-19 June 2013.

- [C13] Rugini, P. Banelli, "Pilot-aided Estimation of Carrier Frequency Offsets and Channel Impulse Responses for OFDM Cooperative Communications," Proc. of IEEE SPAWC 2012, Cesme, Turkey, June 2012.
- [C14] L. Rugini, P. Banelli, H. A. Suraweera, and C. Yuen, "Performance of Alamouti space-time coded OFDM with carrier frequency offset," Proc. of IEEE GLOBECOM 2011, Houston, Texas, USA, December 5-9, 2011.
- [C15] G. Bafna, P. Banelli, and L. Rugini, "Three-stage centralized spectrum sensing of OFDM signals," IEEE Int. Workshop on Signal Processing Advances in Wireless Communications (SPAWC 2011), San Francisco, California, USA, pp. 286-290, June 26-29, 2011.
- [C16] P. Banelli, L. Rugini, "An H-Infinity Filtering Approach for Robust Tracking of OFDM Doubly-Selective Channels," Proc. of IEEE SPAWC 2010, Marrakech, Morocco, June 20-23, 2010.
- [C17] A. Polpetta, P. Banelli, "Huffman Sequence Design for Coded Excitation in Medical Ultrasound," 2009 IEEE International Ultrasonics Symposium, Roma, Italy, Sept. 20-23, 2009.
- [C18] M. Poggioni, L. Rugini, P. Banelli, "Multistage Decoding-Aided Channel Estimation and Equalization for DVB-H in Single-Frequency Networks," Proc. of IEEE SPAWC 2009, Perugia, Italy, June 2009.
- [C19] L. Rugini, P. Banelli, K. Fang, G. Leus, "Enhanced Turbo MMSE Equalization for MIMO-OFDM over Rapidly Time-Varying Frequency-Selective Channels," Proc. of IEEE SPAWC 2009, Perugia, Italy, June 2009.
- [C20] M. Poggioni, M. Berio, P. Banelli, "BER Performance of Multibeam Satellite Systems with Tomlinson-Harashima Precoding," IEEE ICC 2009, Dresden, Germany, June 14-18, 2009.
- [C21] M. G. Martini, A. Polpetta and P. Banelli, "Context-aware Multi-lead ECG Compression Based on Standard Image Codecs", Proc. of IEEE Int. Conf. on Pervasive Computing Technology for Healthcare, London, March-April 2009.
- [C22] A. Polpetta, P. Banelli, "Fully Digital Pacemaker Detection in ECG Signals Using a Non-Linear Filtering Approach," Proc. of IEEE EMBC 2008, pp. 5406-5410, Vancouver (BC), Canada, August 20-24, 2008.
- [C23] L. Rugini, P. Banelli, "Frequency-Domain Extended Models for Equalization of Doubly-Selective Channels," Proc. of IEEE SPAWC 2008, pp. 520-524, Recife, Pernambuco, Brazil, July 5-8, 2008.
- [C24] L. Rugini, P. Banelli, M. Berio, "Block Equalization for Single-Carrier Satellite Communications with high mobility receivers," Proc. of IEEE Globecom 2007, pp. 5021-5025, Washington D.C., USA, Nov. 26-30, 2007.
- [C25] M. Poggioni, L. Rugini, P. Banelli, "Analyzing Performance of Multi-User Scheduling Jointly with AMC and ARQ," Proc. of IEEE Globecom 2007, pp. 3483-3488, Washington D.C., USA, November 26-30, 2007.
- [C26] M. Poggioni, L. Rugini, P. Banelli, "A Novel Simulation Model for Coded OFDM in Doppler Scenarios: DVB-T versus DAB," Proc. of IEEE ICC 2007, pp. 5689-5694, Glasgow, Scotland, UK, June 2007.
- [C27] L. Rugini, P. Banelli, "Performance Analysis of Banded Equalizers for OFDM Systems in Time-Varying Channels," Proc. of IEEE SPAWC'07, pp. 1-5, Helsinki, Finland, June 17-20, 2007.
- [C28] P. Banelli, C. R. Cannizzaro, L. Rugini, "Data-aided Kalman Tracking for channel estimation in Doppler-affected OFDM systems," Proc. of IEEE ICASSP-2007, vol. 3, pp. 133-136, Honolulu, Hawaii, USA, April 2007.
- [C29] L. Rugini, P. Banelli, "Banded Equalizers for MIMO-OFDM in Fast Time-varying Channels", invited paper to EURASIP European Signal Processing Conference, EUSIPCO 2006, Florence, Italy, Sept. 2006.
- [C30] C.R. Cannizzaro, P. Banelli, G. Leus, "Adaptive Channel Estimation for OFDM Systems with Doppler spreads," Proc. of IEEE SPAWC'06, Cannes, France, July 2006.

- [C31] Z. Tang, G. Leus, P. Banelli, "Pilot-Assisted Time-Varying OFDM Channel Estimation Based on Multiple OFDM Symbols," Proc. of IEEE SPAWC'06, Cannes, France, July 2006.
- [C32] Z. Tang, G. Leus, C.R. Cannizzaro, P. Banelli, "Pilot-Assisted Time-Varying OFDM Channel Estimation," Proc. of IEEE ICASSP'06, vol.4, pp. 133-136, Toulouse, France, May 2006.
- [C33] L. Rugini, P. Banelli, C. R. Cannizzaro, G. Leus, "Channel Estimation and Windowed DFE for OFDM with Doppler spread," Proc. of IEEE ICASSP'06, vol. 4, pp. 137-140, Toulouse, France, May 2006.
- [C34] L. Rugini, P. Banelli, "Windowing techniques for ICI mitigation in Multicarrier Systems," Proc. of EURASIP European Signal Processing Conference 2005, EUSIPCO'05, Antalya, Turkey, September 2005.
- [C35] L. Rugini, P. Banelli, G. Leus, "Block DFE and Windowing for Doppler-affected OFDM Systems," Proc. of IEEE Int. Conf. on Signal Processing Advances for Wireless Communications 2005, SPAWC'05, pp. 488-492, N.Y.C., New York, U.S.A., June 2005.
- [C36] L. Rugini, P. Banelli, G. Leus, "Reduced-Complexity Equalization for MC-CDMA over Time-Varying Channels," Proc. of IEEE Int. Conf. on Acoustic, Speech and Sig. Processing 2005, ICASSP'05, vol. 3, pp. 473-476, Philadelphia, PA, U.S.A., March 2005.
- [C37] L. Rugini, P. Banelli, S. Cacopardi, "Probability of Error of OFDM Systems with Carrier Frequency Offset in Frequency-Selective Fading Channels," IEEE ICC 2004 Conf., vol. 6, pp. 3289-3293, Paris, France, June 2004.
- [C38] L. Rugini, P. Banelli, G. B. Giannakis, "MMSE-Based Local ML Detection of Linearly Precoded OFDM Signals," IEEE ICC 2004 Conference, vol. 6, pp. 3270-3275, Paris, France, June 2004.
- [C39] L. Rugini, P. Banelli, "BER of MC-DS-CDMA systems with CFO and nonlinear distortions," Proc. of IEEE Int. Conf. on Acoustic, Speech and Sig. Process. ICASSP'04, vol. 4, pp. 773-776, Montreal, Canada, May 2004.
- [C40] P. Banelli, L. Rugini, "BER Performance Degradation of MC-DS-CDMA Systems jointly affected by Transmitter HPA and Receiver CFO in Frequency Selective Fading Channels," Proc. of IEEE ISCCSP 2004, pp. 67-70, Hammamet, Tunisia, March 2004.
- [C41] L. Rugini, P. Banelli, S. Cacopardi, "Regularised MMSE multiuser detection using Covariance Matrix Tapering", Proc. of ICC 2003 Conference, vol. 4, pp. 2460-2464, Anchorage, Alaska, U.S., May 2003.
- [C42] P. Banelli, L. Rugini, S. Cacopardi, "Optimum Output Power Back-Off in Non-linear Channels for OFDM based WLAN", Proc. of IEEE ISSPIT 2002, Marrakesh, Morocco, Dec. 2002.
- [C43] L. Rugini, P. Banelli, S. Cacopardi, "Effects of High-Power Amplification on Linear Multiuser Detectors Performance in DS-CDMA Frequency-Selective Fading Channels", Proc. of IEEE Globecom 2002 Conference, vol. 2, pp. 1061 -1065, Taipei, Taiwan, R.O.C., November 2002.
- [C44] P. Banelli, G. Leus, G. B. Giannakis, "Bayesian Estimation of Clipped Gaussian Processes with Application to OFDM", Proc. of EUSIPCO 2002 Conference, vol. 1, pp. 181-184, Toulouse, France, September 2002.
- [C45] L. Rugini, P. Banelli, S. Cacopardi, "Performance Analysis of the Decorrelating Multiuser Detector for Nonlinear Amplified DS-CDMA Signals", Proc. of IEEE ICC 2002 Conference, vol. 3, pp. 1466-1470, N.Y.C., New York, April 2002.
- [C46] L. Rugini, P. Banelli, S. Cacopardi, "An analytical upper bound on MMSE performance using approximated MMSE multiuser detector in flat Rayleigh fading channels", Proc. of Europ. Wireless 2002, Florence, Italy, Feb. 2002.
- [C47] P. Banelli, S. Cacopardi, L. Rugini, "Improved Performance of MMSE Multiuser Receivers for Asynchronous CDMA: Preliminary Results", Proc. of IEEE -ICC 2001, vol. 6, pp. 1959-1963, Helsinki, Finland, June 2001.

- [C48] P. Banelli, S. Cacopardi, L. Rugini, "Estimation Errors Sensitivity of MMSE Multiuser Receivers in DS-CDMA", COST Action 262 Workshop – Schloss Reisenburg (Ulm) – Germany, Jan. 2001
- [C49] P. Banelli, "Error Sensitivity In Adaptive Predistortion Systems", Proc. of IEEE GLOBECOM'99, vol. 1b, pp. 883-888, Rio de Janeiro, Brazil, Nov. 1999.
- [C50] S. Andreoli, P. Banelli, F. Marrocolo, and C. Massini, "HPA Non Linear Distortions in DVB-T Systems. Simulation and Measurement," 1998 URSI Int. Symp. on Signals, Systems and Electr., pp. 124-127, Pisa, Oct. 1998.
- [C51] P. Banelli, S. Cacopardi, F. Frescura, G. Reali, "Counteraction of Non-Linear Distortion in a Novel MCM-DS-SS WLAN Radio Subsystem", Proc. of IEEE GLOBECOM'97, pp. 320-326, Phoenix, AZ, USA, Nov. 1997.
- [C52] S. Andreoli, P. Banelli, A. Longaroni, C. Massini, "Non Linear Distortions Introduced by Amplifiers on COFDM Signals. Measurements, Effects and Compensation Techniques,". Proc. of 9th Tyrrhenian International Workshop on Digital Communications, Lerici, ITALY, September 1997, M. Luise, S. Pupolin Editors, Springer Verlag, ISBN:9783540762379
- [C53] P. Banelli, G. Baruffa, S. Cacopardi, F. Frescura, G. Reali, "Comparison Of WLAN Multicarrier DS-SS Physical Layer Configurations In Measured Indoor Environment", Proc. of the 1st Int. Workshop on Multicarrier Spread-Spectrum, Oberpfaffenhofen, Germany, 1997
- [C54] P. Banelli, S. Cacopardi, F. Frescura, G. Reali, "OM-DS-SS Wireless LAN Radio Subsystem: Performance In Clipping Environment Using Measured Channel Delay Profiles", Proc. of IEEE GLOBECOM '96, pp. 1897 –1903, London, UK, Nov. 1996.

PB

- Patents

- [PT1] Italian Patent Application # PG 2008 A 0041, "Sistema di Individuazione di Impulsi di Pacemaker in un Segnale Elettrocardiografico," Proprietary and Inventors: A. Polpetta, P. Banelli, filed: 14 August 2008.
- [PT2] European Patent n.00830422.2-2211 (IT MC990051), "Baseband Predistortion system for linearising power amplifiers", Proprietary: Itelco s.p.a., Inventors: S. Andreoli, P. Banelli, 17 June 1999.
- [PT3] European Patent n.00830423.0-2211 (IT MC990052), "Mixed baseband-IF predistortion system for linearising power amplifiers", Proprietary: Itelco s.p.a., Inventors: S. Andreoli, P. Banelli, R. Betti, E. Fumi, 17 June 1999.

Perugia, 24/08/2020

Sign Paolo Bauer