

Prof. Dr. Helmut Bölcskei  
Dept. IT & EE  
ETH Zurich  
Sternwartstrasse 7  
8092 Zurich, Switzerland

Phone: +41-44-6323433  
Fax: +41-44-6321209  
email: boelcskei@nari.ee.ethz.ch  
<http://www.nari.ee.ethz.ch/boelcskei>

September 2017

## I. CURRICULUM VITAE

**RESEARCH** Information Theory, Mathematical Signal Processing, Machine Learning Theory, Statistics

**PERSONAL DETAILS** Born on May 29, 1970 in Mödling, Austria; Austrian nationality; married, one child (Philip, born Nov. 20, 2005)

**EDUCATION** 1989 – 1994: Studies in electrical engineering, Vienna University of Technology, Vienna, Austria  
Oct. 1994: Engineering diploma (M.S.) with highest honors  
1994 – 1997: Doctoral studies in electrical engineering, Vienna University of Technology, Vienna, Austria  
Nov. 1997: Ph.D. in electrical engineering with highest honors (doctoral dissertation: “Over-sampled Filter Banks and Predictive Subband Coders,” thesis advisors: Prof. F. Hlawatsch, Department of Electrical Engineering, Vienna University of Technology, and Prof. H. G. Feichtinger, Department of Mathematics, University of Vienna)

**ACADEMIC WORK EXPERIENCE** Oct. 2006 – : Full Professor (o. Univ.-Prof.) of Electrical Engineering, Department of Information Technology and Electrical Engineering, ETH Zurich, Zurich, Switzerland  
Feb. 2002 – Sept. 2006: Assistant Professor (tenure track) of Electrical Engineering, Department of Information Technology and Electrical Engineering, ETH Zurich, Zurich, Switzerland  
March 2001 – Jan. 2002: Assistant Professor (tenure track) of Electrical and Computer Engineering, Coordinated Science Laboratory and Department of Electrical Engineering, University of Illinois at Urbana-Champaign, Urbana-Champaign, IL, USA  
Feb. 1999 – Feb. 2001: Post-doctoral researcher in the Information Systems Laboratory (with Prof. A. Paulraj), Dept. of Electrical Engineering, and in the Department of Statistics (with Prof. D. Donoho), Stanford University, Stanford, CA, USA  
Sept. 1998: One-week stay at the Isaac Newton Institute for Mathematical Sciences, Cambridge, UK  
Feb. 1998 – March 1998: Visiting Researcher at Ecole Nationale Supérieure des Télécommunications (ENST) Paris, Paris, France (with Prof. P. Duhamel)  
May 1997 – Jan. 1999: University Assistant (“Universitätsassistent”), Department of Electrical Engineering, Vienna University of Technology, Vienna, Austria  
Dec. 1994 – Apr. 1997: Research and Teaching Assistant (“wissenschaftlicher Mitarbeiter”), Department of Electrical Engineering, Vienna University of Technology, Vienna, Austria

INDUSTRIAL  
WORK  
EXPERIENCE

Oct. – Nov. 1994: Research Assistant (“wissenschaftlicher Mitarbeiter”), Department of Mathematics, University of Vienna, Vienna, Austria

2007: Co-founder of *Celestrius AG*, Zurich, Switzerland, company liquidated in 2011

July 2004: Consulting for *Beceem Communications Inc.*, Santa Clara, CA, USA

June 2001: Visiting researcher at the *Heinrich-Hertz Institut für Nachrichtentechnik Berlin GmbH*, Berlin, Germany

March 2001 – July 2001: Consulting for *Iospan Wireless Inc.*, work on physical layer and system architecture of second generation “Air Burst” system

Feb. 1999 – Feb. 2001: Member of founding team and part-time member of technical staff in the startup company *Iospan* (formerly *Gigabit Wireless Inc.*, San Jose, CA, USA, founded by Prof. A. Paulraj, acquired in 2002 by Intel Corp.; development of orthogonal frequency division multiple access (OFDMA)-based physical layer and system architecture for a cellular fixed broadband wireless access (BWA) system using multiple-antenna (MIMO) technology (“Air Burst” system), MIMO channel measurements and development of MIMO channel models for fixed BWA in the US MMDS band (2.5 – 2.7GHz)

Jan. 1998 – Dec. 1998: Consulting for the Austrian company *AKG* on low-delay audio coding

Feb. – May 1996: Visiting Researcher at *Philips Research Laboratories Eindhoven*, The Netherlands (work on image and video coding)

AWARDS AND  
HONORS

2016 Padovani Lecturer, IEEE Information Theory Society

Thomson Reuters (ISI) Highly Cited Researcher in the category *Computer Science*, 2014

IEEE Information Theory Society Distinguished Lecturer, 2013 – 2014

EURASIP Fellow 2011

(“*In 2007, the EURASIP Administrative Committee (AdCom) initiated a Fellowship Programme, to recognize outstanding achievements of its members and volunteers. Each year, a select group of signal processing researchers are elevated to “EURASIP Fellow”, the Association’s most prestigious honor.*”)

Invited speaker at the first EU-US Frontiers of Engineering (FoE) Meeting, Sept. 2010, Cambridge, UK

Vodafone Innovations Award 2010

(“*Der Innovationspreis zeichnet exzellente Wissenschaftlerinnen und Wissenschaftler vorwiegend aus dem deutschen Sprachraum aus. Er ist mit 25.000 EUR dotiert. Bei der Auswahl finden herausragende Arbeiten, die die Entwicklung der Mobil- und Festnetzkommunikation zum Thema haben, eine besondere Beachtung.*”)

Editor-in-chief ad interim, *IEEE Transactions on Information Theory*, Nov. 2013 – Dec. 2013

Editor-in-chief, *IEEE Transactions on Information Theory*, July 2010 – June 2013

Fellow of IEEE, class of 2009, nominated by IEEE Information Theory Society, citation: “For contributions to multiple-input multiple-output wireless communication and filter bank theory”

ICICS 2008/2009 Distinguished Lecture, The University of British Columbia, Vancouver, Canada

2006 IEEE Communications Society *Leonard G. Abraham Prize*

(“*Given annually to the best original paper published in the IEEE Journal on Selected Areas in Communications in the past year.*”)

2005 “Golden Owl” Teaching Award for the Department of Information Technology and Electrical Engineering, ETH Zurich

2001 IEEE Signal Processing Society Young Author Best Paper Award

(“*The Young Author Best Paper Award honors the author(s) of an especially meritorious paper dealing with a subject related to the Society’s technical scope and appearing in one of the Society’s Transactions and who, upon the date of submission of the paper, is less than 30 years of age. Eligibility is based on a three-year window.*”)

Erwin Schrödinger Fellowship (1999 – 2001) given by the Austrian National Science Foundation

PLENARY  
LECTURES

“Vandermonde matrices and the large sieve,” *Workshop on Smart Antennas (WSA)*, Berlin, Germany, March 2017

“The mathematics of deep learning,” *North American School on Information Theory (NASIT)*, Duke University, Raleigh, NC, USA, June 2016

“Super-resolved system identification,” *Kailath Lecture and Colloquium*, Stanford, CA, USA, Sept. 2015.

“Robust subspace clustering via thresholding,” *International ITG Conference on Systems, Communications, and Coding*, Hamburg, Germany, Feb. 2015

“Theoretical challenges in MIMO wireless,” *Marconi Society 40th Anniversary Symposium*, US National Academy of Sciences, Washington D.C., USA, Oct. 2014

“Signal recovery, uncertainty relations, and Minkowski dimension,” *Matheon Workshop on Compressed Sensing and its Applications*, Berlin, Germany, Dec. 2013

“Rényi information dimension and degrees of freedom in vector interference channels,” *Seventh IEEE Workshop on Advanced Information Processing for Wireless Communication Systems (AIPWCS)*, Aalborg, Denmark, Nov. 2013

“Rényi information dimension and degrees of freedom in vector interference channels,” *IEEE International Workshop on Signal Processing Advances in Wireless Communications (SPAWC)*, Darmstadt, Germany, June 2013

“Compressive system identification,” *Kailath Lecture and Colloquium*, Stanford University, Stanford, CA, USA, Apr. 2013

“The SIMO pre-log can be larger than the SISO pre-log,” *International ITG Workshop on Smart Antennas (WSA)*, Dresden, Germany, Mar. 2012

“Compressive system identification,” *International Symposium on Wireless Communication Systems (ISWCS)*, Aachen, Germany, Nov. 2011

“Nonparametric identification of linear time-varying systems,” *53rd International Symposium ELMAR*, Zadar, Croatia, Sept. 2011

“Uncertainty relations and signal recovery,” *European Signal Processing Conference (EU-SIPCO)*, Barcelona, Spain, Sept. 2011

“The SIMO pre-log can be larger than the SISO pre-log,” *IEEE Communication Theory Workshop (CTW)*, Sitges, Spain, June 2011

“How sensitive is fading channel capacity to the channel model?,” *International Conference on Wireless Communications and Signal Processing (WCSP)*, Suzhou, China, Oct. 2010

“On the sensitivity of noncoherent capacity to the channel model,” *Kailath Lecture and Colloquium*, Stanford University, Stanford, CA, USA, Nov. 2009

“Mathematical roots of compressed sensing,” *IEEE Information Theory Workshop (ITW)*, Taormina, Italy, Oct. 2009

“The case for optimum detection algorithms in MIMO wireless systems,” *IEEE Israel Convention*, Eilat, Israel, Dec. 2008

“Capacity of underspread fading channels,” *IEEE Sensor Array and Multichannel Signal Processing Workshop*, Darmstadt, Germany, July 2008

“Soft-output sphere decoding: Theory and VLSI implementation,” *Conference on “Wireless Intelligent Networks” to celebrate the opening of the Wireless Intelligent Networking Center at Nile University*, Cairo, Egypt, Apr. 2008

“Sphere decoding: Theory and VLSI implementation,” *IEEE Benelux/DSP Valley Signal Processing Symposium*, Antwerp, Belgium, March 2007

“Frequency-domain algorithms for efficient polynomial matrix inversion and QR decomposition,” *IEEE International Workshop on Computational Advances in Multi-Sensor Adaptive Processing (CAMSAP)*, Puerto Vallarta, Mexico, Dec. 2005

“Wideband OFDM communication,” *IEEE International Symposium on Spread Spectrum Techniques and Applications (ISSSTA)*, Sydney, Australia, Sept. 2004

“Fundamental tradeoffs in MIMO wireless systems,” *IEEE 6th CAS Workshop/Symposium on Emerging Technologies: Frontiers of Mobile and Wireless Communication*, Shanghai, China, June 2004

“Space-time modulation for real-world MIMO-OFDM systems,” COST 273 Workshop on “Opportunities of the Multidimensional Propagation Channel”, Espoo, Finland, May 2002

“MIMO wireless communications,” *IEEE Benelux Signal Processing Symposium (SPS)*, Leuven, Belgium, March 2002

“Digital signal processing challenges in MIMO wireless communications,” *2001 IEEE Workshop on Signal Processing Systems (SIPS)*, Antwerp, Belgium, Sept. 2001

ERDŐS NUMBER Erdős number: 3

- P. Erdős and J. H. van Lint, “On the average ratio of the smallest and largest prime divisor of  $n$ ,” *Nederl. Akad. Wetensch. Indag. Math.*, 44 (1982), 127–132.
- I. Hall, A. J. E. M. Janssen, A. W. J. Kolen, and J. H. van Lint, “Equidistant codes with distance 12,” *Discrete Mathematics* 17 (1977), pp. 71–83.
- H. Bölcskei and A. J. E. M. Janssen, “Gabor frames, unimodularity, and window decay,” *The Journal of Fourier Analysis and Applications*, Vol. 6, No. 3, 2000, pp. 255–276.

RESEARCH  
GRANTS  
OBTAINED

“Nonstationary graphical model discovery,” (given by the *Swiss National Science Foundation (SNF)*), funding 229K (CHF), 9/2017 – 8/2021

“Multiuser and multicellular MIMO wireless systems,” (given by the *Swiss National Science Foundation (SNF)*), funding 250K (CHF), jointly with Dr. J. Hansen (IKT/ETHZ), 10/2005 – 9/2008

“Multi-standard software defined radio for multimedia applications,” (given by the *Swiss Federal Office for Professional Education and Technology (KTI/CTI)*), Industrial partner *BridgeCo AG, Dübendorf, Switzerland*, funding 387K (CHF), jointly with Prof. W. Fichtner (IIS, ETHZ), 3/2005 – 9/2006

“Performance assessment and coexistence issues of ultra-wideband radio systems (PACURS),” (given by the *Swiss Federal Office for Professional Education and Technology (KTI/CTI)*), Industrial partner *Swisscom Innovations AG*, funding 231K (CHF), 3/2004 – 2/2006

“Multi-user MIMO wireless systems,” (given by the *Swiss National Science Foundation (SNF)*), funding 170K (CHF), 5/2003 – 4/2005

“Cooperative MIMO wireless networks,” (given by the *Swiss Federal Office for Education and Science (BBW)*, *COST-273*), funding 100K (CHF), jointly with Prof. A. Wittneben (IKT, ETHZ), 1/2003 – 12/2004

“Real-time MIMO-OFDM system for high-speed broadband wireless access,” (given by *ETHZ Research Commission (TH and SEP)*), funding 1.2M (CHF), jointly with Prof. W. Fichtner (IIS, ETHZ), 8/2002 – 7/2005

Grant J1868–TEC (follow-up to J1629–TEC), “Redundant signal expansions in wireless communications,” (given by the *Austrian National Science Foundation (FWF)*), funding 35K (US), 2/2000 – 1/2001

Grant J1629–TEC, “Redundant signal expansions in wireless communications,” (given by the *Austrian National Science Foundation (FWF)*), funding 35K (US), 2/1999 – 1/2000

INDUSTRY  
SPONSORED  
RESEARCH

“Relaying strategies for real-world wireless networks,” with *Nokia Research Center (NRC) Helsinki, Finland*, 6/2006 – 12/2006, funding 42K (CHF)

“MIMO-OFDM system development and algorithm implementation for future mobile communications (MAGIC),” with *Siemens AG ICM PA, Bocholt, Germany*, 1/2005 – 12/2005, funding 320K (CHF), jointly with Prof. W. Fichtner (IIS, ETHZ)

“Multi-user MIMO communications,” with *Nokia Research Center (NRC) Helsinki, Finland*, 5/2005 – 4/2006, funding 128K (CHF)

“Wideband distributed antenna systems,” with *Nokia Research Center (NRC) Helsinki, Finland*, 5/2005 – 4/2006, funding 70K (CHF)

“MIMO-OFDM system development and algorithm implementation for future mobile communications (MAGIC),” with *Siemens AG ICM PA, Bocholt, Germany*, 1/2004 – 12/2004, funding 320K (CHF), jointly with Prof. W. Fichtner (IIS, ETHZ)

“Multi-antenna techniques for HSDPA (part of the national German 3GET project),” with *Nokia Research Center (NRC) Bochum, Germany*, 1/2004 – 12/2004, funding 175K (CHF)

“Code design for semi-coherent MIMO-OFDM systems (part of Nokia’s 4G cellular systems research project),” with *Nokia Research Center (NRC) Helsinki, Finland*, 1/2004 – 12/2004, funding 70K (CHF)

“MIMO radio channel modeling and channel emulator development for 4G cellular and next-generation WLAN systems,” with *Elektrobit Ltd., Oulu, Finland*, 1/2003 – 6/2004, funding 210K (CHF)

“WLAN MIMO radio channel measurements,” with *Zyray Wireless Inc., San Diego, CA, USA*, 1/2003 – 3/2003, funding 18K (CHF)

“Code design for semi-coherent MIMO-OFDM systems (part of Nokia’s 4G cellular systems research project),” with *Nokia Research Center (NRC) Helsinki, Finland*, 1/2003 – 12/2003, funding 125K (CHF)

EU PROJECTS

FP6 STREP “Multiple-access space-time coding testbed (MASCOT),” project coordinator *Forschungszentrum Telekommunikation Wien (FTW)*, 1/2006 – 12/2008, funding 1.95M (CHF), jointly with Prof. W. Fichtner (IIS, ETHZ)

FP6 STREP “Multi-element multi-hop backhaul reconfigurable antenna network (MEMBRANE),” project coordinator *Imperial College London, UK*, 1/2006 – 6/2008, funding 900K (CHF)

FP6 Network of Excellence “Network of excellence in communications (NEWCOM),” project coordinator *Istituto Superiore Mario Boella, Torino, Italy*, 1/2004 – 9/2005, funding 206K (CHF), jointly with Proff. D. Dahlhaus, H. A. Loeliger, and A. Wittneben (all ETHZ)

FP6 Integrated Project “Pervasive ultra-wideband low spectral energy radio systems (PULSERS) Phase II,” project coordinator *Gesellschaft für Wissens- und Technologietransfer (GWT), Dresden, Germany*, 1/2006 – 12/2007, funding 500K (CHF), jointly with Prof. A. Wittneben (IKT, ETHZ)

FP6 Integrated Project “Pervasive ultra-wideband low spectral energy radio systems (PULSERS),” project coordinator *Gesellschaft für Wissens- und Technologietransfer (GWT), Dresden, Germany*, 1/2004 – 12/2005, funding 618K (CHF), jointly with Prof. A. Wittneben (IKT, ETHZ)

FP6 Integrated Project “Wireless world initiative new radio (WINNER),” project coordinator  
*Siemens AG, Germany, 1/2004 – 12/2005, funding 687K (CHF)*

TEACHING  
ACTIVITIES

University of Illinois at Urbana-Champaign

- Aug. 2001 – Dec. 2002: course “ECE310 - Digital Signal Processing,” (4-units undergraduate course)

Swiss Federal Institute of Technology (ETH) Zurich

- since 2/2018: course “Mathematics of Information,” (5-units graduate course in the MS program “Data Science”, spring semester, taught in English)
- since 10/2002: course “Signal- und Systemtheorie I,” (4-units undergraduate course, winter semester, taught in German)
- since 4/2003: course “Fundamentals of Wireless Communication,” (4-units graduate course, summer semester, taught in English)
- 2009-2017: course “Harmonic Analysis: Theory and Applications in Advanced Signal Processing,” (4-units graduate course, summer semester, taught in English)
- developed course for D-ITET doctoral school C3 on “MIMO Wireless Communications,” jointly with Dr. R. Nabar, taught by Dr. Nabar in summer semesters 2003 and 2004
- Co-organizer of a seminar on *Topics in Communications, Information Theory, and Signal Processing* (jointly with Prof. A. Lapidoth), winter semester 2002/2003

CURRENT PHD  
STUDENTS

Recep Gül: Network information theory and Shannon theory

Dmytro Perekrestenko: Approximation theory and deep learning

Michael Tschannen: Clustering, learning theory

Verner Vlačić: Mathematics of deep learning

PHD STUDENTS  
GRADUATED

T. Wiatowski, “Harmonic analysis of deep convolutional neural networks,” 2017

C. Aubel, “Performance of super-resolution methods in parameter estimation and system identification,” 2016

D. Stotz, “Fractal dimension in information theory,” 2015, ETH medal for outstanding PhD thesis

R. Heckel, “Sparse signal processing: Subspace clustering and system identification,” 2014, ETH medal for outstanding PhD thesis

G. Pope, “Structured sparse signal recovery in general Hilbert spaces,” 2013

P. Kuppinger, “General uncertainty relations and sparse signal recovery,” 2011

V. I. Morgenshtern, “Crystallization and noncoherence in wireless communication,” 2010, ETH medal for outstanding PhD thesis

D. Cescato, “Interpolation-based matrix arithmetics for MIMO-OFDM systems,” 2010

J. Thukral, “Spatial multiplexing in multiuser networks with limited feedback,” 2009

C. Akçaba, “Diversity-multiplexing tradeoff in relay and interference channels,” 2009

C. Studer, “Iterative MIMO decoding: Algorithms and VLSI implementation aspects,” 2009, co-advised with Prof. W. Fichtner, IIS/ETHZ

P. Coronel, “Diversity-multiplexing tradeoff in selective fading channels,” 2008

U. G. Schuster, “Wireless communication over wideband channels,” 2007

M. Gärtner, “Space-time coding and multiple access in MIMO fading channels,” 2007

M. Borgmann, “Noncoherent MIMO wideband communications,” 2007

D. S. Baum, “Information-theoretic analysis of a class of MIMO channel measurement devices,” 2007

A. P. Burg, “VLSI circuits for MIMO communication systems,” 2006, co-advised with Prof. W. Fichtner, IIS/ETHZ

#### EDITORSHIPS

Member of editorial board of *Foundations and Trends in Communications and Information Theory*, since 5/2012

Member of editorial board of *Foundations and Trends in Networking*, since 1/2005

Member of editorial board of *IEEE Signal Processing Magazine*, 1/2012 – 12/2014

Associate editor for *IEEE Transactions on Information Theory*, 6/2007 – 5/2010

Associate editor for *IEEE Transactions on Wireless Communications*, 2/2002 – 12/2005

Associate editor for *EURASIP Journal on Applied Signal Processing*, 7/2003 – 6/2005

Associate editor for *IEEE Transactions on Signal Processing*, 5/2000 – 5/2005

Guest editor for a special issue on “Signal Processing for Multiple-Input Multiple-Output (MIMO) Wireless Communication Systems,” in the *IEEE Transactions on Signal Processing*, Nov. 2003

Guest editor for a special section in *Signal Processing (EURASIP)* entitled “From Signal Processing Theory to Implementation,” July 2003

#### CONFERENCE ORGANIZATION

Technical program co-chair of *IEEE Information Theory Workshop (ITW) 2016*, Cambridge, UK, 2016

Co-chair of *Joint Workshop on Coding and Communications (JWCC)*, Barcelona, Spain, 2014

Co-chair of *2014 International Zurich Seminar on Communications (IZS)*, Zurich, Switzerland, 2014

Co-chair of *2012 International Zurich Seminar on Communications (IZS)*, Zurich, Switzerland, 2012

Co-chair of *Joint Workshop on Coding and Communications (JWCC)*, Santo Stefano Belbo, Italy, 2010

Co-chair of *2010 International Zurich Seminar on Communications (IZS)*, Zurich, Switzerland, 2010

Technical program co-chair of *IEEE International Symposium on Information Theory (ISIT) 2008*, Toronto, Canada, 2008

Panel sessions co-chair of *International Conference on Acoustics, Speech, and Signal Processing (ICASSP)*, Las Vegas, NV, USA, 2008

Co-chair of *Joint Workshop on Coding and Communications (JWCC)*, Dürnstein, Austria, 2007

Special sessions and plenary talks co-chair of *European Signal Processing Conference (EUSIPCO)*, Florence, Italy, 2006

Technical program co-chair of *2006 IEEE Workshop on Signal Processing Advances in Wireless Communications (SPAWC)*, Cannes, France, 2006

Co-Chair of *2006 International Zurich Seminar on Communications (IZS)*, Zurich, Switzerland, 2006

Member of organizing committee for *UngerboeckFest (in honor of Dr. G. Ungerböck's 65th birthday)*, Hertenstein, Switzerland, 2005

Co-Chair of *2004 International Zurich Seminar on Communications (IZS)*, Zurich, Switzerland, 2004

Co-Chair of *Communication Theory Symposium, IEEE Global Telecommunications Conference (GLOBECOM)*, San Francisco, CA, USA, 2003

Co-Chair of *Advanced Signal Processing in Communications Symposium, IEEE International Conference on Communications (ICC)*, Anchorage, AK, USA, 2003

PROFESSIONAL  
ACTIVITIES

2nd Vice President, IEEE Information Theory Society, 2018

Chair of IEEE Information Theory Society James L. Massey Award for Young Scholars, 2017-2018

Member of the Master in Data Science admissions committee, ETH Zurich, since 2017

Member of IEEE Undergraduate Teaching Award Committee, 2016, chair 2017-2018

Member of search committee Dean STI, EPFL, 2016

Member of the international review panel for the evaluation of the Dept. of Electrical and Computer Engineering, TU Munich, 2016

Member of the Scientific Advisory Board, Swiss Innovation Valley, Switzerland, since 2015

Member of the Scientific Advisory Board, Fraunhofer Zukunftsstiftung, Fraunhofer Society, Germany, since 2015

Member of the IEEE Information Theory Society Board of Governors, 2009-2011, 2015-2017

Member of the IEEE Information Theory Society *Claude E. Shannon Award Selection Committee*, 2015-2016

Member of the *Vodafone Innovations Award Committee*, since 2015

Member of the *IEEE Alexander Graham Bell Medal Committee*, 2015-2017

Member of review panel, LOEWE Program, Hessen, Germany, Technical University of Darmstadt, Darmstadt, Germany, Sept. 2013

Member of review panel, Zentrum für Innovation und Technologie (zit), Vienna, Austria, June 2013

ERC Advanced Grant Panel Member, since 2013

Member of the IEEE Information Theory Society External Nominations Committee, 2013, chair 2014-2015

Member of the IEEE Information Theory Society Fellows Committee, 2013-2015, chair 2016-2018

Scientific advisory board, *Forschungszentrum für Telekommunikation Wien (ftw)*, 2010-2013

Member of the IEEE Information Theory Society Board of Governors, 2009-2011

Delegate of the president of ETH Zurich for faculty searches, since 2008

Member of the MS admissions committee, Dept. of Information Technology and Electrical Engineering, ETH Zurich, 2007-2010

Member of the *IEEE Signal Processing Society's Technical Committee on Signal Processing for Communications*, 2002-2008

Officer in the *European Signal Processing Society (EURASIP)*, 2002-2006



## II. PUBLICATIONS AND PATENTS

5 representative papers marked with \*

1. EDITED BOOK
- 1.1 H. Bölcskei, D. Gesbert, C. Papadias, and A. J. van der Veen, eds., “Space-time wireless systems: From array processing to MIMO communications,” Cambridge University Press, 2006.
2. INVITED BOOK CHAPTERS
- 2.1 V. I. Morgenshtern and H. Bölcskei, “A short course on frame theory,” *Mathematical Foundations for Signal Processing, Communications, and Networking*, E. Serpedin, T. Chen, and D. Rajan, eds., CRC Press, 2011, pp. 737–789.
- 2.2 G. Durisi, V. I. Morgenshtern, H. Bölcskei, U. G. Schuster, and S. Shamai (Shitz), “Information theory of underspread WSSUS channels,” *Wireless Communications over Rapidly Time-Varying Channels*, F. Hlawatsch and G. Matz, eds., Academic Press, 2011, pp. 65–116.
- 2.3 H. Bölcskei, “Principles of MIMO-OFDM wireless systems,” in *Signal Processing for Mobile Communications Handbook*, M. Ibukahla, ed., CRC Press, 2004, pp. 12.1–12.22.
- 2.4 H. Bölcskei, “Orthogonal frequency division multiplexing based on offset QAM,” in *Advances in Gabor Analysis*, H. G. Feichtinger and T. Strohmer, eds., Birkhäuser, 2003, pp. 321–352.
- 2.5 H. Bölcskei and A. J. Paulraj, “Multiple-input multiple-output (MIMO) wireless systems,” in *The Communications Handbook*, 2nd edition, J. Gibson, ed., CRC Press, 2002, pp. 90.1–90.14.
- 2.6 H. Bölcskei and F. Hlawatsch, “Oversampled modulated filter banks,” in *Gabor Analysis: Theory, Algorithms, and Applications*, H. G. Feichtinger and T. Strohmer, eds., Birkhäuser, 1998, pp. 295–322.
- 3.A INVITED JOURNAL PAPERS
- 3.1 G. Durisi and H. Bölcskei, “High-SNR capacity of wireless communication channels in the noncoherent setting: A primer,” *International Journal of Electronics and Communications (AEÜ)*, Vol. 65, Issue 8, Aug. 2011, pp. 707–712.
- 3.2 H. Bölcskei, “MIMO-OFDM wireless systems: Basics, perspectives and challenges,” *IEEE Wireless Communications*, Vol. 13, No. 4, Aug. 2006, pp. 31–37.
- 3.3 A. Burg, M. Borgmann, M. Wenk, M. Zellweger, W. Fichtner, and H. Bölcskei, “VLSI implementation of MIMO detection using the sphere decoding algorithm,” *IEEE Journal of Solid-State Circuits*, Vol. 40, No. 7, July 2005, pp. 1566–1577.
- 3.4 A. J. Paulraj, D. A. Gore, R. U. Nabar, and H. Bölcskei, “An overview of MIMO communications - A key to Gigabit wireless,” *Proceedings of the IEEE*, Vol. 92, No. 2, Feb. 2004, pp. 198–218.
- 3.5 R. U. Nabar, V. Erceg, H. Bölcskei, and A. J. Paulraj, “Performance of multi-antenna signaling strategies using dual-polarized antennas: Measurement results and analysis,” *Wireless Personal Communications*, Vol. 23, Issue 1, 2002, pp. 31–44; reprinted from *Fourth International Symposium on Wireless Personal Multimedia Communications (WPMC)*, Sept. 2001, Aalborg, Denmark, pp. 175–180.
- 3.6 H. Bölcskei, A. J. Paulraj, K. V. S. Hari, R. U. Nabar, and W. W. Lu, “Fixed broadband wireless access: State of the art, challenges, and future directions,” *IEEE Communications Magazine*, Vol. 39, No. 1, Jan. 2001, pp. 100–108.
- 3.B JOURNAL PAPERS PUBLISHED OR ACCEPTED FOR PUBLICATION
- 3.7 T. Wiatowski, P. Grohs, and H. Bölcskei, “Energy propagation in deep convolutional neural networks,” *IEEE Trans. Information Theory*, 2018, to appear.

- 3.8 M. Tschannen and H. Bölcskei, “Robust nonparametric nearest neighbor random process clustering,” *IEEE Trans. Signal Processing*, 2017, to appear.
- 3.9\* C. Aubel and H. Bölcskei, “Vandermonde matrices with nodes in the unit disk and the large sieve,” *Applied and Computational Harmonic Analysis*, 2017, to appear.
- 3.10 C. Aubel, D. Stotz, and H. Bölcskei, “A theory of super-resolution from short-time Fourier transform measurements,” *Journal of Fourier Analysis and Applications*, 2017, to appear.
- 3.11 D. Stotz, E. Riegler, E. Agustsson, and H. Bölcskei, “Almost lossless analog signal separation and probabilistic uncertainty relations,” *IEEE Trans. Information Theory*, Vol. 63, No. 9, pp. 5445-5460, Sept. 2017.
- 3.12 R. Heckel, M. Tschannen, and H. Bölcskei, “Dimensionality-reduced subspace clustering,” *Information and Inference: A Journal of the IMA*, Vol. 6, No. 3, pp. 246-283, Sept. 2017.
- 3.13\* D. Stotz and H. Bölcskei, “Characterizing degrees of freedom through additive combinatorics,” *IEEE Trans. Information Theory*, Vol. 62, No. 11, pp. 6423-6435, Nov. 2016.
- 3.14 D. Stotz and H. Bölcskei, “Degrees of freedom in vector interference channels,” *IEEE Trans. Information Theory*, Vol. 62, No. 7, pp. 4172-4197, July 2016.
- 3.15 R. Heckel and H. Bölcskei, “Robust subspace clustering via thresholding,” *IEEE Trans. Information Theory*, Vol. 61, No. 11, pp. 6320-6342, Dec. 2015.
- 3.16 R. Heckel and H. Bölcskei, “Identification of sparse linear operators,” *IEEE Trans. Information Theory*, Vol. 59, No. 12, pp. 7985-8000, Dec. 2013.
- 3.17 G. Matz, H. Bölcskei, and F. Hlawatsch, “Time-frequency foundations of communications,” *IEEE Signal Processing Magazine*, Vol. 30, No. 6, pp. 87-96, Nov. 2013.
- 3.18\* V. I. Morgenshtern, E. Riegler, W. Yang, G. Durisi, S. Lin, B. Sturmfels, and H. Bölcskei, “Capacity pre-log of noncoherent SIMO channels via Hironaka’s Theorem,” *IEEE Trans. Information Theory*, Vol. 59, No. 7, pp. 4213-4229, July 2013.
- 3.19\* G. Durisi, V. I. Morgenshtern, and H. Bölcskei, “On the sensitivity of continuous-time noncoherent fading channel capacity,” *IEEE Trans. Information Theory*, Vol. 58, No. 10, pp. 6372-6391, Oct. 2012.
- 3.20 C. Akçaba and H. Bölcskei, “Diversity-multiplexing tradeoff in two-user fading interference channels,” *IEEE Trans. Information Theory*, Vol. 58, No. 7, pp. 4462-4480, July 2012.
- 3.21 C. Studer, P. Kuppinger, G. Pope, and H. Bölcskei, “Recovery of sparsely corrupted signals,” *IEEE Trans. Information Theory*, Vol. 58, No. 5, May 2012, pp. 3115-3130.
- 3.22 P. Kuppinger, G. Durisi, and H. Bölcskei, “Uncertainty relations and sparse signal recovery for pairs of general signal sets,” *IEEE Trans. Information Theory*, Vol. 58, No. 1, Jan. 2012, pp. 263-277.
- 3.23 D. S. Baum and H. Bölcskei, “Information-theoretic analysis of MIMO channel sounding,” *IEEE Trans. Information Theory*, Vol. 57, No. 11, Nov. 2011, pp. 7555-7577.
- 3.24 D. Seethaler, J. Jaldén, C. Studer, and H. Bölcskei, “On the complexity distribution of sphere decoding,” *IEEE Trans. Information Theory*, Vol. 57, No. 9, Sept. 2011, pp. 5754-5768.
- 3.25 D. Cescato and H. Bölcskei, “Algorithms for interpolation-based QR decomposition in MIMO-OFDM systems,” *IEEE Trans. Signal Processing*, Vol. 59, No. 4, Apr. 2011, pp. 1719-1733.
- 3.26 C. Studer and H. Bölcskei, “Soft-input soft-output single tree-search sphere decoding,” *IEEE Trans. Information Theory*, Vol. 56, No. 10, Oct. 2010, pp. 4827-4842.
- 3.27 D. Cescato and H. Bölcskei, “QR decomposition of Laurent polynomial matrices sampled on the unit circle,” *IEEE Trans. Information Theory*, Vol. 56, No. 9, Sept. 2010, pp. 4754-4761.

- 3.28 Y. C. Eldar, P. Kuppinger, and H. Bölcskei, “Block-sparse signals: Uncertainty relations and efficient recovery,” *IEEE Trans. Signal Processing*, Vol. 58, No. 6, June 2010, pp. 3042–3054.
- 3.29 D. Seethaler and H. Bölcskei, “Performance and complexity analysis of infinity-norm sphere-decoding,” *IEEE Trans. Information Theory*, Vol. 56, No. 3, March 2010, pp. 1085–1105.
- 3.30 G. Durisi, U. G. Schuster, H. Bölcskei, and S. Shamai (Shitz), “Noncoherent capacity of underspread fading channels,” *IEEE Trans. Information Theory*, Vol. 56, No. 1, Jan. 2010, pp. 367–395.
- 3.31 U. G. Schuster, G. Durisi, H. Bölcskei, and H. V. Poor, “Capacity bounds for peak-constrained multiantenna wideband channels,” *IEEE Trans. Comm.*, Vol. 57, No. 9, Sept. 2009, pp. 2686–2696.
- 3.32 D. E. Quevedo, H. Bölcskei, and G. C. Goodwin, “Quantization of filter bank frame expansions through moving horizon optimization,” *IEEE Transactions on Signal Processing*, Vol. 57, No. 2, Feb. 2009, pp. 503–515.
- 3.33\* C. Studer, A. P. Burg, and H. Bölcskei, “Soft-output sphere decoding: Algorithms and VLSI implementation,” *IEEE Journal on Selected Areas in Communications*, Vol. 26, No. 2, Feb. 2008, pp. 290–300.
- 3.34 V. I. Morgenshtern and H. Bölcskei, “Crystallization in large wireless networks,” *IEEE Trans. Information Theory*, Vol. 53, No. 10, Oct. 2007, pp. 3319–3349.
- 3.35 U. G. Schuster and H. Bölcskei, “Ultrawideband channel modeling on the basis of information-theoretic criteria,” *IEEE Trans. Wireless Comm.*, Vol. 6, No. 7, July 2007, pp. 2464–2475.
- 3.36 S. Visuri and H. Bölcskei, “Multiple-access strategies for frequency-selective MIMO channels,” *IEEE Trans. Information Theory*, Vol. 52, No. 9, Sept. 2006, pp. 3980–3993.
- 3.37 H. Bölcskei, R. U. Nabar, Ö. Oyman, and A. J. Paulraj, “Capacity scaling laws in MIMO relay networks,” *IEEE Trans. Wireless Communications*, Vol. 5, No. 6, June 2006, pp. 1433–1444.
- 3.38 R. U. Nabar, H. Bölcskei, and A. J. Paulraj, “Diversity and outage performance in Ricean MIMO channels,” *IEEE Trans. Wireless Communications*, Sept. 2005, Vol. 4, No. 5, pp. 2519–2532.
- 3.39 M. Borgmann and H. Bölcskei, “Noncoherent space-frequency coded MIMO-OFDM,” *IEEE Journal on Selected Areas in Communications (Special Issue on “Differential and noncoherent wireless communications”)*, Vol. 23, No. 9, Sept. 2005, pp. 1799–1810. (received the 2006 IEEE Communications Society Leonard G. Abraham Prize)
- 3.40 R. U. Nabar, H. Bölcskei, and F. W. Kneubühler, “Fading relay channels: Performance limits and space-time signal design,” *IEEE Journal on Selected Areas in Communications (Special Issue on “Fundamental performance limits of wireless sensor networks”)*, Vol. 22, No. 6, Aug. 2004, pp. 1099–1109.
- 3.41 Ö. Oyman, R. U. Nabar, H. Bölcskei, and A. J. Paulraj, “Characterizing the statistical properties of mutual information in MIMO channels,” *IEEE Trans. Signal Processing (Special Issue on “Signal Processing for MIMO Wireless Communications”)*, Vol. 51, No. 11, Nov. 2003, pp. 2784–2795.
- 3.42 H. Bölcskei, P. Duhamel, and R. Hleiss, “Orthogonalization of OFDM/OQAM pulse shaping filters using the discrete Zak transform,” *Signal Processing (EURASIP)*, Vol. 83, No. 7, July 2003, pp. 1379–1391.
- 3.43 Y. C. Eldar and H. Bölcskei, “Geometrically uniform frames,” *IEEE Transactions on Information Theory*, Vol. 49, No. 4, Apr. 2003, pp. 993–1006.

- 3.44 H. Bölcskei, M. Borgmann, and A. J. Paulraj, "Impact of the propagation environment on the performance of space-frequency coded MIMO-OFDM," *IEEE Journal on Selected Areas in Communications (Special Issue on "MIMO Systems and Applications")*, Vol. 21, No. 3, Apr. 2003, pp. 427–439.
- 3.45 D. Gesbert, H. Bölcskei, D. A. Gore, and A. J. Paulraj, "Outdoor MIMO wireless channels: Models and performance prediction," *IEEE Trans. Communications*, Vol. 50, No. 12, Dec. 2002, pp. 1926–1934.
- 3.46 R. U. Nabar, H. Bölcskei, V. Erceg, D. Gesbert, and A. J. Paulraj, "Performance of multi-antenna signaling techniques in the presence of polarization diversity," *IEEE Transactions on Signal Processing (Special Issue on "Signal Processing Techniques for Space-Time-Coded Transmissions")*, Vol. 50, No. 10, Oct. 2002, pp. 2553–2562.
- 3.47 D. Gesbert, L. Haumonte, H. Bölcskei, R. Krishnamoorthy, and A. J. Paulraj, "Technologies and performance for non-line-of-sight broadband wireless access networks," *IEEE Communications Magazine*, Vol. 40, No. 4, Apr. 2002, pp. 86–95.
- 3.48 H. Bölcskei, D. Gesbert, and A. J. Paulraj, "On the capacity of OFDM-based spatial multiplexing systems," *IEEE Trans. Communications*, Vol. 50, No. 2, Feb. 2002, pp. 225–234.
- 3.49 H. Bölcskei, R. W. Heath Jr., and A. J. Paulraj, "Blind channel identification and equalization in OFDM-based multi-antenna systems," *IEEE Trans. Signal Processing*, Vol. 50, No. 1, Jan. 2002, pp. 96–109.
- 3.50 H. Bölcskei, P. Duhamel, and R. Hleiss, "A subspace-based approach to blind channel identification in pulse shaping OFDM/OQAM systems," *IEEE Trans. Signal Processing*, Vol. 49, No. 7, July 2001, pp. 1594–1598.
- 3.51 H. Bölcskei, "Blind estimation of symbol timing and carrier frequency offset in wireless OFDM systems," *IEEE Trans. Communications*, Vol. 49, No. 6, June 2001, pp. 988–999.
- 3.52 H. Bölcskei and F. Hlawatsch, "Noise reduction in oversampled filter banks using predictive quantization," *IEEE Trans. Information Theory*, Vol. 47, No. 1, Jan. 2001, pp. 155–172.
- 3.53 H. Bölcskei and A. J. E. M. Janssen, "Gabor frames, unimodularity, and window decay," *The Journal of Fourier Analysis and Applications*, Vol. 6, No. 3, 2000, pp. 255–276.
- 3.54 H. Bölcskei, R. Heusdens, R. Theunis, and A. J. E. M. Janssen, "Design of orthogonal and biorthogonal lapped transforms satisfying perception related constraints," *IEEE Trans. Image Processing*, Vol. 9, No. 5, May 2000, pp. 760–772.
- 3.55 A. J. E. M. Janssen and H. Bölcskei, "Equivalence of two methods for constructing tight Gabor frames," *IEEE Signal Processing Letters*, Vol. 7, No. 4, Apr. 2000, pp. 79–82.
- 3.56 H. Bölcskei, "A necessary and sufficient condition for dual Weyl-Heisenberg frames to be compactly supported," *The Journal of Fourier Analysis and Applications*, Vol. 5, No. 5, 1999, pp. 409–419.
- 3.57 H. Bölcskei, F. Hlawatsch, and H. G. Feichtinger, "Frame-theoretic analysis of oversampled filter banks," *IEEE Trans. Signal Processing*, Vol. 46, No. 12, Dec. 1998, pp. 3256–3268. (received *IEEE Signal Processing Society 2001 Young Author Best Paper Award*).
- 3.58 H. Bölcskei and F. Hlawatsch, "Oversampled cosine modulated filter banks with perfect reconstruction," *IEEE Trans. Circuits and Systems II (Special Issue on "Multirate Systems, Filter Banks, Wavelets and Applications")*, Vol. 45, No. 8, Aug. 1998, pp. 1057–1071.
- 3.59 H. Bölcskei, K. Gröchenig, F. Hlawatsch, and H. G. Feichtinger, "Oversampled Wilson expansions," *IEEE Signal Processing Letters*, Vol. 4, No. 4, Apr. 1997, pp. 106–108.
- 3.60 H. Bölcskei and F. Hlawatsch, "Discrete Zak transforms, polyphase transforms, and applications," *IEEE Trans. Signal Processing*, Vol. 45, No. 4, Apr. 1997, pp. 851–866.

- 3.61 F. Hlawatsch and H. Bölcskei, "Covariant time-frequency distributions based on conjugate operators," *IEEE Signal Processing Letters*, Vol. 3, No. 2, Feb. 1996, pp. 44–46.
- 3.C JOURNAL PAPERS UNDER REVIEW
- 3.62 C. Aubel and H. Bölcskei, "Stability analysis of subspace methods for cisoid parameter estimation," *IEEE Trans. Information Theory*, Sept. 2017, submitted.
- 3.63 C. Aubel and H. Bölcskei, "Density criteria for the identification of linear operators," *SIAM J. Math. Anal.*, Sept. 2017, submitted.
- 3.64 H. Bölcskei, P. Grohs, G. Kutyniok, and P. Petersen, "Optimal approximation with sparsely connected deep neural networks," *Journal of the American Mathematical Society*, May 2017, submitted.
- 3.65 M. Tschannen and H. Bölcskei, "Noisy subspace clustering via matching pursuits," *IEEE Trans. Information Theory*, Dec. 2016, submitted.
- 3.66 T. Wiatowski and H. Bölcskei, "A mathematical theory of deep convolutional neural networks for feature extraction," *IEEE Trans. Information Theory*, Dec. 2015, submitted.
- 3.D JOURNAL PAPERS IN PREPARATION
- 3.67 G. Alberti, H. Bölcskei, C. De Lellis, G. Koliander, and E. Riegler, "Lossless analog compression," *IEEE Trans. Information Theory*, in preparation.
- 3.68 E. Riegler, D. Stotz, and H. Bölcskei, "Information-theoretic limits of matrix completion," *IEEE Trans. Information Theory*, in preparation.
- 4.A INVITED CONFERENCE PAPERS
- 4.1 T. Wiatowski, P. Grohs, and H. Bölcskei, "Topology reduction in deep convolutional feature extraction networks," *Prof. of SPIE (Wavelets and Sparsity XVII)*, Aug. 2017, to appear.
- 4.2 H. Bölcskei, P. Grohs, G. Kutyniok, and P. Petersen, "Memory-optimal neural network approximation," *Prof. of SPIE (Wavelets and Sparsity XVII)*, Aug. 2017, to appear.
- 4.3 R. Heckel and H. Bölcskei, "Joint sparsity with different measurement matrices," *Allerton Conference on Communication, Control, and Computing, Monticello, IL*, Oct. 2012, pp. 698–702.
- 4.4 P. Kuppinger, G. Durisi, and H. Bölcskei, "Improved sparsity thresholds through dictionary splitting," *IEEE Information Theory Workshop*, Taormina, Italy, Oct. 2009, pp. 338–342.
- 4.5 C. Studer, D. Seethaler, and H. Bölcskei, "Finite lattice-size effects in MIMO decoding," *Asilomar Conference on Signals, Systems, and Computers*, Pacific Grove, CA, USA, Oct. 2008.
- 4.6 J. Thukral and H. Bölcskei, "Distributed spatial multiplexing with 1-bit feedback," *Allerton Conference on Communication, Control, and Computing*, Monticello, IL, USA, Sept. 2007, pp. 502–509.
- 4.7 C. Studer, M. Wenk, A. P. Burg, and H. Bölcskei, "Soft-Output MIMO detection algorithms: Performance and implementation aspects," *Asilomar Conf. on Signals, Systems, and Computers*, Pacific Grove, CA, USA, Oct. 2006, pp. 2071–2076.
- 4.8 V. I. Morgenshtern and H. Bölcskei, "Random matrix analysis of large relay networks," *Allerton Conference on Communication, Control, and Computing*, Monticello, IL, USA, Sept. 2006, pp. 106–112.
- 4.9 A. P. Burg, M. Borgmann, M. Wenk, C. Studer, and H. Bölcskei, "Advanced receiver algorithms for MIMO wireless communications," *Proc. Design, Automation, and Test in Europe Conf. (DATE)*, Vol. 1, Mar. 2006, pp. 593–598.
- 4.10 V. I. Morgenshtern and H. Bölcskei, "On the value of cooperation in large interference relay networks," *Allerton Conference on Communication, Control, and Computing*, Monticello, IL, USA, Sept. 2005, pp. 1939–1949.

- 4.11 D. Cescato, M. Borgmann, H. Bölcskei, J. C. Hansen, and A. P. Burg, "Interpolation-based QR decomposition in MIMO-OFDM systems," *IEEE Workshop on Signal Processing Advances in Wireless Communications (SPAWC)*, June 2005, New York City, NY, USA, pp. 965–969.
- 4.12 U. G. Schuster and H. Bölcskei, "How different are UWB channels from conventional wide-band channels?," *International Workshop on Convergent Technologies (IWCT)*, Oulu, Finland, June 2005.
- 4.13 M. Borgmann and H. Bölcskei, "Interpolation-based efficient matrix inversion for MIMO-OFDM receivers," *38th Asilomar Conf. on Signals, Systems, and Computers*, Pacific Grove, CA, USA, Nov. 2004, pp. 1941–1947.
- 4.14 R. U. Nabar and H. Bölcskei, "Capacity scaling laws in asynchronous relay networks," *Allerton Conference on Communication, Control, and Computing*, Monticello, IL, USA, Oct. 2004, pp. 502–511.
- 4.15 D. S. Baum and H. Bölcskei, "Impact of phase noise on MIMO channel measurement accuracy," *IEEE Vehicular Technology Conference (VTC) Fall*, Los Angeles, CA, USA, Sept. 2004, pp. 1614–1618.
- 4.16 S. Häne, D. Perels, D. S. Baum, M. Borgmann, A. Burg, N. Felber, W. Fichtner, and H. Bölcskei, "Implementation aspects of a real-time multi-terminal MIMO-OFDM testbed," *IEEE Radio and Wireless Conference (RAWCON)*, Atlanta, GA, USA, Sept. 2004 (*slides published only*).
- 4.17 S. Visuri and H. Bölcskei, "On multiple accessing for frequency selective MIMO channels," *European Signal Processing Conference (EUSIPCO)*, Vienna, Austria, Sept. 2004, pp. 523–527.
- 4.18 R. U. Nabar, Ö. Oyman, H. Bölcskei, and A. J. Paulraj, "Capacity scaling laws in MIMO wireless networks," *Allerton Conference on Communication, Control, and Computing*, Monticello, IL, USA, Oct. 2003, pp. 378–389.
- 4.19 H. Bölcskei and M. Borgmann, "Code design for non-coherent MIMO-OFDM systems," *Allerton Conference on Communication, Control, and Computing*, Monticello, IL, USA, Oct. 2002, pp. 237–246.
- 4.20 H. Bölcskei, M. Borgmann, and A. J. Paulraj, "Performance of space-frequency coded broadband OFDM under real-world propagation conditions," *European Signal Processing Conference (EUSIPCO)*, Toulouse, France, Sept. 2002, pp. 413–416.
- 4.21 R. U. Nabar, H. Bölcskei, and A. J. Paulraj, "Influence of propagation conditions on the outage capacity of space-time block codes," *European Wireless Conference*, Florence, Italy, Feb. 2002, Vol. 1, pp. 629–634.
- 4.22 R. U. Nabar, V. Erceg, H. Bölcskei, and A. J. Paulraj, "Performance of multi-antenna signaling strategies using dual-polarized antennas: Measurement results and analysis," *IEEE International Symposium on Wireless Personal Multimedia Communications (WPMC)*, Aalborg, Denmark, Sept. 2001, pp. 175–180.
- 4.23 H. Bölcskei and A. J. Paulraj, "Performance of space-time codes in the presence of spatial fading correlation," *Asilomar Conference on Signals, Systems, and Computers*, Pacific Grove, CA, USA, Oct./Nov. 2000, Vol. 1, pp. 687–693.
- 4.24 D. Gesbert, H. Bölcskei, D. A. Gore, and A. J. Paulraj, "Performance evaluation for scattering MIMO channel models," *Asilomar Conference on Signals, Systems, and Computers*, Pacific Grove, CA, USA, Oct./Nov. 2000, Vol. 1, pp. 748–752.
- 4.25 H. Bölcskei, R. W. Heath Jr., and A. J. Paulraj, "Blind equalization in OFDM-based multi-antenna systems," *Adaptive Systems for Signal Processing, Communications, and Control Symposium (AS-SPCC)*, Lake Louise, Alberta, Canada, Oct. 2000, pp. 58–63.

- 4.26 H. Bölcskei and A. J. Paulraj, “Space-frequency coded broadband OFDM systems,” *IEEE Wireless Communications and Networking Conference (WCNC)*, Chicago, IL, USA, Sept. 2000, Vol. 1, pp. 1–6.
- 4.27 H. Bölcskei, “Efficient design of pulse shaping filters for OFDM systems,” *SPIE Proc., “Wavelet Applications in Signal and Image Processing VII”*, Denver, CO, USA, July 1999, Vol. 3813, pp. 625–636.
- 4.28 P. Grohs, T. Wiatowski, and H. Bölcskei, “Energy decay and conservation in deep convolutional neural networks,” *IEEE Int. Symposium on Information Theory (ISIT)*, Aachen, Germany, June 2017, pp. 1356-1360.
- 4.29 D. Stotz, S. Jafar, S. Shamai (Shitz), and H. Bölcskei, “Canonical conditions for  $K/2$  degrees of freedom,” *IEEE Int. Symposium on Information Theory (ISIT)*, Barcelona, Spain, July 2016, pp. 1292-1296.
- 4.30 P. Grohs, T. Wiatowski, and H. Bölcskei, “Deep convolutional neural networks on cartoon functions,” *IEEE Int. Symposium on Information Theory (ISIT)*, Barcelona, Spain, July 2016, pp. 1163-1167.
- 4.31 C. Aubel and H. Bölcskei, “Deterministic performance analysis of subspace methods for cisoid parameter estimation,” *IEEE Int. Symposium on Information Theory (ISIT)*, Barcelona, Spain, July 2016, pp. 1551-1555.
- 4.32 G. Alberti, H. Bölcskei, C. De Lellis, G. Koliander, and E. Riegler, “Lossless linear analog compression,” *IEEE Int. Symposium on Information Theory (ISIT)*, Barcelona, Spain, July 2016, pp. 2789-2793.
- 4.33 T. Wiatowski, M. Tschannen, A. Stanić, P. Grohs, and H. Bölcskei, “Discrete deep feature extraction: A theory and new architectures,” *International Conference on Machine Learning (ICML)*, New York, USA, June 2016, pp. 2149-2158.
- 4.34 T. Wiatowski and H. Bölcskei, “Deep convolutional neural networks based on semi-discrete frames,” *IEEE Int. Symposium on Information Theory (ISIT)*, Hong Kong, China, June 2015, pp. 1212-1216.
- 4.35 C. Aubel and H. Bölcskei, “Density criteria for the identification of linear time-varying systems,” *IEEE Int. Symposium on Information Theory (ISIT)*, Hong Kong, China, June 2015, pp. 2568-2572.
- 4.36 E. Riegler, D. Stotz, and H. Bölcskei, “Information-theoretic limits of matrix completion,” *IEEE Int. Symposium on Information Theory (ISIT)*, Hong Kong, China, June 2015, pp. 1836-1840.
- 4.37 M. Tschannen and H. Bölcskei, “Nonparametric nearest neighbor random process clustering,” *IEEE Int. Symposium on Information Theory (ISIT)*, Hong Kong, China, June 2015, pp. 1207-1211.
- 4.38 D. Stotz and H. Bölcskei, “Explicit and almost sure conditions for  $K/2$  degrees of freedom,” *IEEE Int. Symposium on Information Theory (ISIT)*, Honolulu, HI, USA, July 2014, pp. 471–475.
- 4.39 R. Heckel, M. Tschannen, and H. Bölcskei, “Subspace clustering of dimensionality-reduced data,” *IEEE Int. Symposium on Information Theory (ISIT)*, Honolulu, HI, USA, July 2014, pp. 2997–3001.
- 4.40 A. Jung, R. Heckel, H. Bölcskei, and F. Hlawatsch, “Compressive nonparametric graphical model selection for time series,” *IEEE International Conference on Acoustics, Speech, and Signal Processing (ICASSP)*, Florence, Italy, May 2014, pp. 769–773.
- 4.41 R. Heckel, E. Agustsson, and H. Bölcskei, “Neighborhood selection for thresholding-based subspace clustering,” *IEEE International Conference on Acoustics, Speech, and Signal Processing (ICASSP)*, Florence, Italy, May 2014, pp. 6761–6765.

- 4.42 C. Aubel, D. Stotz, and H. Bölcskei, “Super-resolution from short-time Fourier transform measurements,” *IEEE International Conference on Acoustics, Speech, and Signal Processing (ICASSP)*, Florence, Italy, May 2014, pp. 36–40.
- 4.43 D. Stotz, E. Riegler, and H. Bölcskei, “Almost lossless analog signal separation,” *IEEE Int. Symposium on Information Theory (ISIT)*, Istanbul, Turkey, July 2013, pp. 106–110.
- 4.44 R. Heckel and H. Bölcskei, “Noisy subspace clustering via thresholding,” *IEEE Int. Symposium on Information Theory (ISIT)*, Istanbul, Turkey, July 2013, pp. 1382–1386.
- 4.45 R. Heckel and H. Bölcskei, “Subspace clustering via thresholding and spectral clustering,” *IEEE International Conference on Acoustics, Speech, and Signal Processing (ICASSP)*, Vancouver, Canada, May 2013, pp. 3263–3267.
- 4.46 D. Stotz and H. Bölcskei, “Degrees of freedom in vector interference channels,” *Allerton Conference on Communication, Control, and Computing, Monticello, IL*, Oct. 2012, pp. 1755–1760.
- 4.47 G. Pope and H. Bölcskei, “Sparse signal recovery in Hilbert spaces,” *IEEE Int. Symposium on Information Theory (ISIT)*, Boston, MA, July 2012, pp. 1463–1467.
- 4.48 C. Aubel, C. Studer, G. Pope, and H. Bölcskei, “Sparse signal separation in redundant dictionaries,” *IEEE Int. Symposium on Information Theory (ISIT)*, Boston, MA, July 2012, pp. 2047–2051.
- 4.49 R. Heckel and H. Bölcskei, “Compressive identification of linear operators,” *IEEE Int. Symposium on Information Theory (ISIT)*, St. Petersburg, Russia, Aug. 2011, pp. 1412–1416.
- 4.50 E. Riegler, V. I. Morgenshtern, G. Durisi, S. Lin, B. Sturmfels, and H. Bölcskei, “Noncoherent SIMO pre-log via resolution of singularities,” *IEEE Int. Symposium on Information Theory (ISIT)*, St. Petersburg, Russia, Aug. 2011, pp. 2020–2024.
- 4.51 C. Studer, P. Kuppinger, G. Pope, and H. Bölcskei, “Sparse signal recovery from sparsely corrupted measurements,” *IEEE Int. Symposium on Information Theory (ISIT)*, St. Petersburg, Russia, Aug. 2011, pp. 1422–1426.
- 4.52 V. I. Morgenshtern, G. Durisi, and H. Bölcskei, “The SIMO pre-log can be larger than the SISO pre-log,” *IEEE Int. Symposium on Information Theory (ISIT)*, Austin, TX, USA, June 2010, pp. 320–324.
- 4.53 P. Kuppinger, G. Durisi, and H. Bölcskei, “Where is randomness needed to break the square-root bottleneck?,” *IEEE Int. Symposium on Information Theory (ISIT)*, Austin, TX, USA, June 2010, pp. 1578–1582.
- 4.54 G. Durisi, V. I. Morgenshtern, and H. Bölcskei, “On the sensitivity of noncoherent capacity to the channel model,” *IEEE Int. Symposium on Information Theory (ISIT)*, Seoul, Korea, July 2009, pp. 2174–2178.
- 4.55 J. Thukral and H. Bölcskei, “Interference alignment with limited feedback,” *IEEE Int. Symposium on Information Theory (ISIT)*, Seoul, Korea, July 2009, pp. 1759–1763.
- 4.56 D. Seethaler, J. Jalden, C. Studer, and H. Bölcskei, “Tail behavior of sphere-decoding complexity in random lattices,” *IEEE Int. Symposium on Information Theory (ISIT)*, Seoul, Korea, July 2009, pp. 729–733.
- 4.57 C. Akçaba and H. Bölcskei, “On the achievable diversity-multiplexing tradeoff in interference channels,” *IEEE Int. Symposium on Information Theory (ISIT)*, Seoul, Korea, July 2009, pp. 1604–1608.
- 4.58 Y. C. Eldar and H. Bölcskei, “Block-sparsity: Coherence and efficient recovery,” *IEEE International Conference on Acoustics, Speech, and Signal Processing (ICASSP)*, Taipei, Taiwan, Apr. 2009, pp. 2885–2888.
- 4.59 U. G. Schuster, G. Durisi, H. Bölcskei, and H. V. Poor, “Capacity bounds for peak-constrained multiantenna wideband channels,” *IEEE Int. Symposium on Information Theory (ISIT)*, Toronto, ON, Canada, July 2008, pp. 1582–1586.



- 4.60 P. Coronel, M. Gärtner, and H. Bölcskei, “Diversity-multiplexing tradeoff in selective-fading multiple-access MIMO channels,” *IEEE Int. Symposium on Information Theory (ISIT)*, Toronto, ON, Canada, July 2008, pp. 915–919.
- 4.61 D. Seethaler and H. Bölcskei, “Infinity-norm sphere-decoding,” *IEEE Int. Symposium on Information Theory (ISIT)*, Toronto, ON, Canada, July 2008, pp. 2002–2006.
- 4.62 C. Studer and H. Bölcskei, “Soft-input soft-output sphere decoding,” *IEEE Int. Symposium on Information Theory (ISIT)*, Toronto, ON, Canada, July 2008, pp. 2007–2011.
- 4.63 C. Akçaba, P. Kuppinger, and H. Bölcskei, “Distributed transmit diversity in relay networks,” *IEEE Information Theory Workshop (ITW)*, Bergen, Norway, July 2007, pp. 1–5.
- 4.64 G. Durisi, H. Bölcskei, and S. Shamai (Shitz), “Capacity of underspread noncoherent WSSUS fading channels under peak signal constraints,” *IEEE Int. Symposium on Information Theory (ISIT)*, Nice, France, June 2007, pp. 156–160.
- 4.65 P. Coronel and H. Bölcskei, “Diversity-multiplexing tradeoff in selective-fading MIMO channels,” *IEEE Int. Symposium on Information Theory (ISIT)*, Nice, France, June 2007, pp. 2841–2845.
- 4.66 M. Gärtner and H. Bölcskei, “On the “critical rate” in Ricean MIMO channels,” *IEEE Int. Symposium on Information Theory (ISIT)*, Nice, France, June 2007, pp. 526–530.
- 4.67 M. Gärtner and H. Bölcskei, “Multiuser space-time/frequency code design,” *IEEE International Symposium on Information Theory (ISIT)*, Seattle, WA, July 2006, pp. 2819–2823.
- 4.68 G. Durisi, H. Bölcskei, and S. Shamai (Shitz), “Capacity of underspread WSSUS fading channels in the wideband regime,” *IEEE International Symposium on Information Theory (ISIT)*, Seattle, WA, July 2006, pp. 1500–1504.
- 4.69 V. I. Morgenshtern, H. Bölcskei, and R. U. Nabar, “Distributed orthogonalization in large interference relay networks,” *IEEE International Symposium on Information Theory (ISIT)*, Adelaide, Australia, Sept. 2005, pp. 1211–1215.
- 4.70 U. G. Schuster and H. Bölcskei, “Ultra-wideband channel modeling on the basis of information-theoretic criteria,” *IEEE International Symposium on Information Theory (ISIT)*, Adelaide, Australia, Sept. 2005, pp. 97–101.
- 4.71 M. Borgmann and H. Bölcskei, “On the capacity of noncoherent wideband MIMO-OFDM systems,” *IEEE International Symposium on Information Theory (ISIT)*, Adelaide, Australia, Sept. 2005, pp. 651–655.
- 4.72 D. E. Quevedo, G. C. Goodwin, and H. Bölcskei, “Multi-step optimal quantization in oversampled filter banks,” *IEEE Conference on Decision and Control*, Atlantis, Paradise Island, Bahamas, Dec. 2004, pp. 1442–1447.
- 4.73 M. Gärtner and H. Bölcskei, “Ergodic capacity and outage properties of CDMA in multiple-access fading channels,” *International Symposium on Information Theory and its Applications (ISITA)*, Parma, Italy, Oct. 2004, pp. 722–727.
- 4.74 J. C. Hansen and H. Bölcskei, “A geometrical investigation of the rank-1 Ricean MIMO channel at high SNR,” *IEEE International Symposium on Information Theory (ISIT)*, Chicago, IL, USA, June 2004, p. 64.
- 4.75 H. Bölcskei and R. U. Nabar, “Realizing MIMO gains without user cooperation in large single-antenna wireless networks,” *IEEE International Symposium on Information Theory (ISIT)*, Chicago, IL, USA, June 2004, p. 18.
- 4.76 U. G. Schuster, M. Borgmann, and H. Bölcskei, “Semicoherent PPM for wideband communications,” *IEEE International Symposium on Information Theory (ISIT)*, Chicago, IL, USA, June 2004, p. 383.

- 4.77 D. Schafhuber, H. Bölcskei, and G. Matz, "System capacity of wideband OFDM communications over fading channels without channel knowledge," *IEEE International Symposium on Information Theory (ISIT)*, Chicago, IL, USA, June 2004, p. 391.
- 4.78 S. Visuri and H. Bölcskei, "MIMO-OFDM multiple access with variable amount of collision," *IEEE International Conf. on Communications (ICC)*, Paris, France, June 2004, Vol. 1, pp. 286–291.
- 4.79 R. U. Nabar, F. W. Kneubühler, and H. Bölcskei, "Performance limits of amplify-and-forward based fading relay channels," *IEEE International Conference on Acoustics, Speech, and Signal Processing (ICASSP)*, Montreal, Quebec, Canada, May 2004, Vol. 4, pp. 565–568.
- 4.80 R. U. Nabar, H. Bölcskei, and A. J. Paulraj, "Diversity performance of Ricean MIMO channels," *ITG Workshop on Smart Antennas*, Munich, Germany, Mar. 2004, pp. 253–256.
- 4.81 R. U. Nabar and H. Bölcskei, "Space-time signal design for fading relay channels," *IEEE Global Telecommunications Conference (GLOBECOM)*, San Francisco, CA, USA, Dec. 2003, Vol. 4, pp. 1952–1956.
- 4.82 H. Bölcskei, M. Borgmann, and A. J. Paulraj, "Space-frequency coded MIMO-OFDM with variable multiplexing-diversity tradeoff," *IEEE International Conference on Communications (ICC)*, Anchorage, AK, USA, May 2003, Vol. 4, pp. 2837–2841.
- 4.83 Y. C. Eldar and H. Bölcskei, "Structured group frames," *Workshop on Sampling Theory and Applications (SampTA)*, Strobl, Austria, May 2003.
- 4.84 R. U. Nabar, H. Bölcskei, and A. J. Paulraj, "Cut-off rate based transmit optimization for spatial multiplexing on general MIMO channels," *IEEE International Conference on Acoustics, Speech, and Signal Processing (ICASSP)*, Hong Kong, R.O.C., Apr. 2003, Vol. 5, pp. 61–64.
- 4.85 Ö. Oyman, R. U. Nabar, H. Bölcskei, and A. J. Paulraj, "Tight lower bounds on the ergodic capacity of Rayleigh fading MIMO channels," *IEEE Global Telecommunications Conference (GLOBECOM)*, Taipei, Taiwan, R.O.C., Nov. 2002, Vol. 2, pp. 1172–1176.
- 4.86 Ö. Oyman, R. U. Nabar, H. Bölcskei, and A. J. Paulraj, "Characterizing the statistical properties of mutual information in MIMO channels: Insights into diversity-multiplexing tradeoff," *Asilomar Conference on Signals, Systems, and Computers*, Pacific Grove, CA, USA, Nov. 2002, Vol. 1, pp. 521–525.
- 4.87 H. Bölcskei, R. Koetter, and S. Mallik, "Coding and modulation for underspread fading channels," *IEEE International Symposium on Information Theory (ISIT)*, Lausanne, Switzerland, June/July 2002, p. 358.
- 4.88 R. U. Nabar, H. Bölcskei, and A. J. Paulraj, "Outage properties of space-time block codes in correlated Rayleigh or Ricean fading environments," *IEEE International Conference on Acoustics, Speech, and Signal Processing (ICASSP)*, Orlando, FL, USA, May 2002, Vol. 3, pp. 2381–2384.
- 4.89 R. U. Nabar, H. Bölcskei, and A. J. Paulraj, "Transmit optimization for spatial multiplexing in the presence of spatial fading correlation," *IEEE GLOBECOM*, San Antonio, TX, USA, Nov. 2001, Vol. 1, pp. 131–135.
- 4.90 H. Bölcskei and A. J. Paulraj, "Space-frequency codes for broadband fading channels," *IEEE ISIT*, Washington, D.C., USA, June 2001, p. 219.
- 4.91 H. Bölcskei, R. U. Nabar, V. Erceg, D. Gesbert, and A. J. Paulraj, "Performance of spatial multiplexing in the presence of polarization diversity," *IEEE ICASSP*, Salt Lake City, UT, USA, May 2001, Vol. 4, pp. 2437–2440.
- 4.92 R. W. Heath Jr., H. Bölcskei, and A. J. Paulraj, "Space-time signaling and frame theory," *IEEE ICASSP*, Salt Lake City, UT, USA, May 2001, Vol. 4, pp. 2445–2448.

- 4.93 D. Gesbert, H. Bölcskei, D. A. Gore, and A. J. Paulraj, "MIMO wireless channels: Capacity and performance prediction," *IEEE GLOBECOM*, San Francisco, CA, USA, Nov. 2000, pp. 1083–1088.
- 4.94 H. Sampath, H. Bölcskei, and A. J. Paulraj, "Pre-equalization for MIMO wireless channels with delay spread," *IEEE Vehicular Technology Conference (VTC) Fall*, Boston, MA, USA, Sept. 2000, Vol. 3, pp. 1175–1178.
- 4.95 H. Bölcskei, D. Gesbert, and A. J. Paulraj, "On the capacity of OFDM-based multi-antenna systems," *IEEE ICASSP 2000*, Istanbul, Turkey, June 2000, pp. 2569–2572.
- 4.96 H. Bölcskei, R. W. Heath Jr., and A. J. Paulraj, "Blind channel estimation in spatial multiplexing systems using nonredundant antenna precoding," *Asilomar Conf. on Signals, Systems, and Computers*, Pacific Grove, CA, USA, Oct. 1999, pp. 1127–1132.
- 4.97 H. Bölcskei, P. Duhamel, and R. Hleiss, "Design of pulse shaping OFDM/OQAM systems for high data-rate transmission over wireless channels," *IEEE ICC*, Vancouver B.C., Canada, June 1999, Vol. 1, pp. 559–564.
- 4.98 H. Bölcskei, "Blind high-resolution uplink synchronization of OFDM-based multiple access schemes," *IEEE Signal Processing Workshop on Signal Processing Advances in Wireless Communications (SPAWC)*, Annapolis, MD, USA, May 1999, pp. 166–169.
- 4.99 H. Bölcskei, P. Duhamel, and R. Hleiss, "Blind channel identification in high-data-rate pulse shaping OFDM/OQAM systems," *IEEE SPAWC*, Annapolis, MD, USA, May 1999, pp. 154–157.
- 4.100 H. Bölcskei, "Blind estimation of symbol timing and carrier frequency offset in pulse shaping OFDM systems," *IEEE ICASSP*, Phoenix, AZ, USA, March 1999, Vol. 5, pp. 2749–2752.
- 4.101 H. Bölcskei and F. Hlawatsch, "Quantization noise reduction in oversampled filter banks," *IEEE Int. Sympos. Time-Frequency Time-Scale Analysis (TFTS)*, Pittsburgh, PA, USA, Oct. 1998, pp. 509–512.
- 4.102 H. Bölcskei, "Oversampling in wavelet subspaces," *IEEE TFTS*, Pittsburgh, PA, USA, Oct. 1998, pp. 489–492.
- 4.103 A. F. Molisch and H. Bölcskei, "Error floor of pulse amplitude modulation with adaptive sampling phase in time-dispersive fading channels," *IEEE International Symposium on Personal, Indoor and Mobile Radio Communications (PIMRC)*, Boston, MA, USA, Sept. 1998, pp. 884–890.
- 4.104 H. Bölcskei, T. Stranz, F. Hlawatsch, and R. Sucher, "Subband image coding using cosine modulated filter banks with perfect reconstruction and linear phase," *IEEE International Conference on Image Processing (ICIP)*, Santa Barbara, CA, USA, Vol. 2, Oct. 1997, pp. 594–597.
- 4.105 H. Bölcskei and F. Hlawatsch, "Oversampled cosine-modulated filter banks with linear phase," *IEEE International Symposium on Circuits and Systems (ISCAS)*, Hong Kong, June 1997, pp. 357–360.
- 4.106 H. Bölcskei and F. Hlawatsch, "Oversampled filter banks: Optimal noise shaping, design freedom, and noise analysis," *IEEE ICASSP*, Munich, Germany, Apr. 1997, Vol. 3, pp. 2453–2456.
- 4.107 H. Bölcskei and F. Hlawatsch, "Oversampled Wilson-type cosine modulated filter banks," *Asilomar Conf. on Signals, Systems, and Computers*, Pacific Grove, CA, USA, Nov. 1996, pp. 998–1002.
- 4.108 H. Bölcskei, H. G. Feichtinger, K. Gröchenig, and F. Hlawatsch, "Discrete-time Wilson expansions," *IEEE TFTS*, Paris, France, June 1996, pp. 525–528.

- 4.109 F. Hlawatsch, T. Twaroch, and H. Bölcskei, “Wigner-type  $a$ - $b$  and time-frequency analysis based on conjugate operators,” *IEEE ICASSP*, Atlanta, GA, USA, May 1996, Vol. 3, pp. 1395–1398.
- 4.110 H. Bölcskei, F. Hlawatsch, and H. G. Feichtinger, “Frame-theoretic analysis and design of oversampled filter banks,” *IEEE ISCAS*, Atlanta, GA, USA, May 1996, Vol. 2, pp. 409–412.
- 4.111 H. Bölcskei, F. Hlawatsch, and H. G. Feichtinger, “Oversampled FIR and IIR DFT filter banks and Weyl-Heisenberg frames,” *IEEE ICASSP*, Atlanta, GA, USA, May 1996, Vol. 3, pp. 1391–1394.
- 4.112 F. Hlawatsch and H. Bölcskei, “Time-frequency distributions based on conjugate operators,” *IEEE UK Sympos. Applications of Time-Frequency and Time-Scale Methods*, Univ. of Warwick, Coventry, UK, Aug. 1995, pp. 187–193a.
- 4.113 H. Bölcskei, H. G. Feichtinger, and F. Hlawatsch, “Diagonalizing the Gabor frame operator,” *IEEE UK Sympos. Applications of Time-Frequency and Time-Scale Methods*, Univ. of Warwick, Coventry, UK, Aug. 1995, pp. 249–255a.
- 4.114 H. Bölcskei, F. Hlawatsch, and H. G. Feichtinger, “Equivalence of DFT filter banks and Gabor expansions,” *SPIE Proc. Vol. 2569, “Wavelet Applications in Signal and Image Processing III”*, San Diego, CA, USA, July 1995, pp. 128–139.
- 4.115 F. Hlawatsch and H. Bölcskei, “Displacement-covariant time-frequency energy distributions,” *IEEE ICASSP*, Detroit, MI, USA, May 1995, Vol. 2, pp. 1025–1028.
- 4.116 F. Hlawatsch and H. Bölcskei, “Unified theory of displacement-covariant time-frequency analysis,” *IEEE TFTS*, Philadelphia, PA, USA, Oct. 1994, pp. 524–527.
- 4.117 F. Hlawatsch and H. Bölcskei, “Time-frequency analysis of frames,” *IEEE TFTS*, Philadelphia, PA, USA, Oct. 1994, pp. 52–55.

5. PATENTS  
AND INVENTION  
DISCLOSURES

- 5.1 C. Studer, A. P. Burg, and H. Bölcskei, “Computation of extrinsic information in a branch-and-bound detector,” WO/2010/000075 A1 (granted Jan. 7, 2010).
- 5.2 C. Studer, A. P. Burg, and H. Bölcskei, “Modified distance-increments for branch-and-bound detection,” WO/2010/000076 A1 (granted Jan. 7, 2010).
- 5.3 C. Akçaba, P. Kuppinger, H. Bölcskei, and A. Hottinen, “Linear transformation matrices for distributed diversity,” WO/2009/001268 A3 (granted Feb. 12, 2009).
- 5.4 A. P. Burg, H. Bölcskei, M. Borgmann, D. Cescato, and J. C. Hansen, “Method for calculating functions of the channel matrices in linear MIMO-OFDM data transmission,” US patent 7,742,536 (granted Dec. 25, 2008), also EP 1810422 A1, and WO/2006/050627 A1.
- 5.5 H. Bölcskei, P. K. Sebastian, S. Talwar, and A. J. Paulraj, “Diversity transmitter based on linear transform processing of transmitted information,” US patent 6,442,214 (granted Aug. 27, 2002).
- 5.6 A. J. Paulraj, P. K. Sebastian, J. Tellado, R. W. Heath Jr., S. Talwar, and H. Bölcskei, “Wireless communication system and method using stochastic space-time/frequency division multiplexing,” US patent 6,377,632 (granted Apr. 23, 2002).

### III. LECTURES

#### LECTURES

- 1 “*Topology reduction in deep neural networks.*” RWTH Aachen, Aachen, Germany, Aug. 2017.
- 2 “*Vandermonde matrices and the large sieve.*” Vienna University of Technology, Vienna, Austria, Apr. 2017.
- 3 “*Harmonic analysis of convolutional neural networks.*” (i) EPFL, Lausanne, Switzerland, Feb. 2017. (ii) Friedrich Alexander University of Erlangen, Erlangen, Germany, March 2016.
- 4 “*Mathematics of deep learning.*” (i) Swisscom Innovations, Switzerland. (ii) RWTH Aachen, Aachen, Germany, Aug. 2016.
- 5 “*Uncertainty relations.*” EPFL, Lausanne, Switzerland, July 2016.
- 6 “*The mathematics of deep learning.*” Short course at the (i) National University of Singapore, Singapore, May 2016. (ii) North American School of Information Theory (NASIT), Duke University, Raleigh, NC, USA, June 2016.
- 7 “*Information-theoretic limits of compressed sensing.*” National University of Singapore, Singapore, May 2016.
- 8 “*Deep convolutional feature extraction: Theory and new architectures.*” Hausdorff Research Institute for Mathematics (HIM), University of Bonn, Germany, March 2016.
- 9 “*Characterizing degrees of freedom through additive combinatorics.*” (i) Vienna University of Technology, Vienna, Austria, May 2015. (ii) Cambridge University, Cambridge, UK, Oct. 2015, (iii) University College London, London, UK, Oct. 2015.
- 10 “*Robust subspace clustering via thresholding.*” (i) Rasa Networks, San Jose, CA, Oct. 2014. (ii) Google, Mountain View, CA, Oct. 2014.
- 11 “*Explicit and almost sure conditions for  $K/2$  degrees of freedom.*” Stanford University, Stanford, CA, Oct. 2014.
- 12 “*Rényi information dimension and degrees of freedom in vector interference channels.*” (i) Vienna Univ. of Technology, Vienna, Austria, Oct. 2013. (ii) Broadcom Corp., Santa Clara, CA, Oct. 2014.
- 13 “*The SIMO pre-log can be larger than the SISO pre-log.*” Vienna Univ. of Technology, Vienna, Austria, Oct. 2012.
- 14 “*Compressive identification of linear operators.*” Vienna Univ. of Technology, Vienna, Austria, Apr. 2012.
- 15 “*An epilogue of detection algorithms for MIMO wireless.*” Technical University of Dresden, Dresden, Germany, Oct. 2011.
- 16 “*Advanced detection algorithms for MIMO wireless systems.*” Broadcom Corp., San Jose, CA, USA, Aug. 2011.
- 17 “*The SIMO pre-log can be larger than the SISO pre-log.*” Stanford University, Stanford, CA, USA, Aug. 2011.
- 18 “*Weyl-Heisenberg frames and the capacity of fading channels.*” Strobl 11: From Abstract to Computational Harmonic Analysis, Workshop honoring H. G. Feichtinger on the occasion of his 60th birthday, Strobl, Austria, June 2011.
- 19 “*Managing massive interference.*” Vodafone Innovations Award Colloquium, Frankfurt, Germany, May 2010.
- 20 “*Capacity of underspread fading channels.*” Univ. of Vienna, Vienna, Austria, March 2010.
- 21 “*On the sensitivity of noncoherent capacity to the channel model.*” UC Berkeley, USA, Nov. 2009.

- 22 “*Information theory of continuous-time wireless communication channels through Weyl-Heisenberg frames.*” The University of British Columbia, Vancouver, Canada, Jan. 2009.
- 23 “*Noncoherent capacity of continuous-time underspread fading channels.*” Aalborg University, Denmark, Jan. 2009.
- 24 “*Distributed MIMO systems through ‘dumb’ or ‘smart’ scattering.*” Qualcomm Inc. Corporate R&D, San Diego, CA, USA, Oct. 2008.
- 25 “*Geometric aspects of the diversity-multiplexing tradeoff in ISI MIMO channels.*” Joint Workshop on Coding and Communications, St. Helena, CA, USA, Oct. 2008.
- 26 “*Noncoherent capacity of continuous-time underspread fading channels.*” (i) Stanford University, Stanford, CA, USA, Oct. 2008. (ii) University of California, San Diego, CA, USA, Oct. 2008. (iii) Aalborg University, Aalborg, Denmark, Jan. 2009.
- 27 “*Distributed transmit diversity in relay networks.*” IEEE Communication Theory Workshop, St. Croix, US Virgin Islands, May 2008.
- 28 “*Infinity-norm sphere decoding.*” (i) Vienna University of Technology, Vienna, Austria, March 2008. (ii) Colloquium on “Interference and inference in wireless networks” on the occasion of Prof. J. Nosske’s 60th birthday, Technical University of Munich, Munich, Germany, Apr. 2008.
- 29 “*Information-theoretic analysis of MIMO channel sounding.*” Joint Workshop on Coding and Communications (JWCC), Dürnstein, Austria, Oct. 2007.
- 30 “*On the capacity of noncoherent underspread WSSUS fading channels under peak signal constraints.*” Norwegian University of Science and Technology (NTNU), Trondheim, Norway, Apr. 2007.
- 31 “*Soft-output sphere decoding: New tricks for old dogs.*” Information Theory and Applications (ITA) Workshop, University of California at San Diego, San Diego, CA, USA, Jan. 2007.
- 32 “*Soft-sphere decoding: Theory and VLSI implementation.*” (i) Technical University of Vienna, Vienna, Austria, Nov. 2006. (ii) Norwegian University of Science and Technology (NTNU), Trondheim, Norway, Apr. 2007.
- 33 “*‘Crystallization’ in large fading networks.*” (i) Stanford University, Stanford, CA, USA, Apr. 2006. (ii) Mathematical Sciences Research Institute (MSRI), Berkeley, CA, USA, Apr. 2006. (iii) Intel Corp., Santa Clara, CA, USA, Apr. 2006.
- 34 “*Noise shaping quantizers of order  $L > 1$  for ‘general’ frame expansions.*” Banff International Research Station (BIRS), Banff, Canada, March 2006.
- 35 “*Capacity scaling in large wireless networks.*” University of California at Los Angeles, Dec. 2005.
- 36 “*Do we need MIMO in the wideband regime?*” University of Illinois at Chicago, Sept. 2005.
- 37 “*Capacity scaling in large interference relay networks.*” (i) *IEEE Communication Theory Workshop*, Park City, UT, USA, June 2005. (ii) Universite catholique de Louvain, Louvain, Belgium, June 2005.
- 38 “*Interpolation-based MIMO-OFDM receivers.*” (i) Vienna University of Technology, Vienna, Austria, May 2005. (ii) Stanford University, Stanford, CA, USA, June 2005. (iii) Institut Eurecom, Sophia-Antipolis, France, June 2005.
- 39 “*Wideband OFDM communication.*” Imperial College, London, UK, Feb. 2005.
- 40 “*Kapazitätsbetrachtungen in drahtlosen Kommunikationsnetzen.*” University of Erlangen, Germany, Feb. 2005.
- 41 “*Capacity scaling in asynchronous interference relay networks.*” *MATCO Multi-Antenna Research Seminar*, Nokia Research Center (NRC) Helsinki, Finland, Nov. 2004.

- 42 “*Parallel wireless transmission.*” *Second International Workshop on Parallel MRI, Latsis Symposium 2004*, ETH Zurich, Switzerland, Oct. 2004.
- 43 “*On the role of signal space collision in MIMO multiple-accessing.*” *Joint Workshop on Coding and Communications (JWCC)*, Villa Pitiana, Donnini, Italy, Oct. 2004.
- 44 “*Non-cooperative wireless networks.*” Nokia Research Center (NRC) Helsinki, Finland, June 2004.
- 45 “*MIMO systems for fixed broadband wireless access.*” Ericsson Research Center, Kista, Sweden, March 2004.
- 46 “*Wideband OFDM communication.*” *ETH-Technion Information Theory Workshop*, ETH Zurich, Feb. 2004.
- 47 “*MIMO Systeme für drahtlose Übertragung der nächsten Generation.*” Seminar in the series “Informationstechnik und Armeeg,” ETH Zurich, Jan. 2004.
- 48 “*Capacity scaling laws in dense wireless networks.*” (i) Gerhard-Mercator-University, Duisburg, Germany, Jan. 2004. (ii) KTH Stockholm, Sweden, March 2004. (iii) *Workshop on Smart Antennas in Wireless Communications*, Stanford University, Stanford, CA, July 2004.
- 49 “*Capacity scaling laws in MIMO wireless networks.*” (i) *Joint Workshop on Coding and Communications (JWCC)*, Nuits St. Georges, France, Oct. 2003. (ii) Telecommunications Research Center Vienna (FTW), Oct. 2003. (iii) Harvard University, Harvard, MA, USA, Nov. 2003. (iv) Massachusetts Institute of Technology, Boston, MA, USA, Nov. 2003. (v) Stanford University, Stanford, CA, USA, Dec. 2003.
- 50 “*MIMO: What shall we do with all these degrees of freedom?*” (i) Vienna University of Technology, Vienna, Austria, Dec. 2002. (ii) Oulu University of Technology, Oulu, Finland, Apr. 2003. (iii) Nokia Research Center (NRC) Helsinki, Finland, June 2003. (iv) Technical University of Aachen (RWTH), Aachen, Germany, July 2003. (v) *IEEE Communication Theory Workshop*, Mesa, AZ, Apr. 2003. (vi) *BEATS/Wireless IP Seminar*, Loen, Norway, June 2003.
- 51 “*MIMO-OFDM cellular systems.*” Motorola Research Center, Paris, France, Sept. 2002.
- 52 “*Space-time signaling for real-world MIMO-OFDM systems.*” (i) EPFL, Lausanne, Switzerland, Apr. 2002. (ii) IBM Zurich Research Laboratory, Rüschlikon, Switzerland, Apr. 2002.
- 53 “*MIMO wireless systems based on dual-polarized antennas.*” (i) Nokia Research Center (NRC) Helsinki, Finland, March 2002. (ii) IMEC, Leuven, Belgium, March 2002.
- 54 “*Information-theoretic limits and coding for broadband multi-antenna fading channels.*” University of Illinois at Chicago, Chicago, IL, USA, Nov. 2001.
- 55 “*The future of broadband wireless access.*” Technical University of Berlin, Berlin, Germany, June 2001.
- 56 “*Broadband multi-antenna wireless communications.*” (i) University of California at Berkeley, Berkeley, CA, USA, Jan. 2001. (ii) ETH Zürich, Zürich, Switzerland, Feb. 2001.
- 57 “*Multi-antenna broadband wireless communications: Channel modeling, capacity, and OFDM-based space-frequency coding.*” Stanford University, Stanford, CA, USA, Oct. 2000.
- 58 “*Linking Gabor theory and OFDM via Janssen’s duality and biorthogonality theory.*” *D. Gabor Centenary Conference*, Vienna, Austria, May 2000.
- 59 “*OFDM-based multi-antenna broadband wireless communications.*” (i) Georgia Institute of Technology, Atlanta, GA, USA, Mar. 2000. (ii) Massachusetts Institute of Technology, Boston, MA, USA, Mar. 2000. (iii) University of Illinois at Urbana-Champaign, Urbana-Champaign, IL, USA, Apr. 2000.

- 60 “*Blind channel estimation in wireless multi-antenna systems.*” Stanford University, Stanford, CA, USA, Nov. 1999.
- 61 “*Blind receivers for wireless high-data-rate OFDM systems.*” Lucent Technologies, Holmdel, NJ, USA, May 1999.
- 62 “*Blind synchronization and blind channel identification in pulse shaping OFDM systems.*” Stanford University, Stanford, CA, USA, Apr. 1999.
- 63 “*Blind synchronization of OFDM systems for mobile radio applications.*” ETH Zürich, Zürich, Switzerland, Dec. 1998.
- 64 “*Orthogonal frequency division multiplexing for high-data-rate transmission over time-varying wireless channels.*” (i) Delft University, Delft, The Netherlands, Sept. 1998. (ii) Philips Research Laboratories, Eindhoven, The Netherlands, Sept. 1998. (iii) University of Virginia, Charlottesville, VA, USA, Oct. 1998.
- 65 “*Filter banks and frames in  $l_2(Z)$ .*” *Workshop on Gabor Theory and Applications*, Isaac Newton Institute for Mathematical Sciences, Cambridge, UK, Aug. 1998.
- 66 “*Redundant representations in signal processing and communications.*” (i) Ecole Nationale Supérieure des Télécommunications, Paris, France, Feb. 1998. (ii) Institut National de Recherche en Informatique et en Automatique (INRIA), Rocquencourt, France, Feb. 1998. (iii) Ecole Normale Supérieure de Lyon, Lyon, France, Mar. 1998.
- 67 “*Noise shaping in oversampled subband coders.*” (i) AT&T Laboratories, Florham Park, NJ, USA, Oct. 1997. (ii) Lucent Technologies, Murray Hill, NJ, USA, Oct. 1997. (iii) Stanford University, San Francisco, CA, USA, Oct. 1997. (iv) ETH Zürich, Zürich, Switzerland, Nov. 1997.
- 68 “*New results on oversampled filter banks.*” *Workshop on Filter Design*, Technical University of Erlangen, Germany, Apr. 1997.
- 69 “*Oversampled filter banks: Theory, analysis, and design.*” (i) California Institute of Technology, Pasadena, CA, USA, Nov. 1996. (ii) EPFL, Lausanne, Switzerland, Feb. 1997.
- 70 “*Design of lapped transforms.*” Philips Research Laboratories Eindhoven, The Netherlands, May 1996.
- 71 “*Oversampled filter banks.*” Georgia Institute of Technology, Atlanta, GA, USA, May 1996.
- 72 “*Frame-theoretic methods for the analysis and design of oversampled filter banks.*” *European Workshop on Multirate Digital Signal Processing and Applications*, Technical University of Hamburg-Harburg, Germany, March 1996.
- 73 “*Oversampled DFT filter banks and Weyl-Heisenberg frames.*” (i) Technical University of Eindhoven, The Netherlands, Dec. 1995. (ii) Technical University of Erlangen, Germany, Dec. 1995.