



LINKÖPING UNIVERSITY

## CURRICULUM VITAE

Dr. EMIL BJÖRNSSON

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Linköping University  
Department of Electrical Engineering (ISY)  
Division of Communication Systems  
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## EDUCATION

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### **Doctor of Philosophy in Telecommunications**

Feb 2007 – Dec 2011

*KTH Royal Institute of Technology, Stockholm, Sweden.*

Thesis title: *Multiantenna Cellular Communications: Channel Estimation, Feedback, and Resource Allocation.*

Research topics: Multi-antenna cellular communications, multi-user resource allocation with limited channel information, estimation theory, stochastic signal processing, and mathematical optimization.

Supervisors: Björn Ottersten and Mats Bengtsson.

### **Master of Science in Engineering Mathematics**

Sep 2002 – Jan 2007

*Lund University, Lund, Sweden.*

Programme in pure and applied mathematics with specialization in signals, images, and systems.

Average grade: 4.9 out of 5.0. I had extra course credits corresponding to one extra year of studies.

Thesis title: *Beamforming Utilizing Channel Norm Feedback in Multiuser MIMO Systems.*

## ACADEMIC POSITIONS

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### **Associate Professor, Communication Systems**

Dec 2017 – [Ongoing]

*Linköping University, Linköping, Sweden.*

I am employed as Associate Professor (called *biträdande professor* in Swedish) at Linköping University. I work at the Division of Communication Systems, headed by Prof. Erik G. Larsson, at the Department of Electrical Engineering (ISY). Current research interests are multi-antenna cellular communications, massive MIMO techniques, radio resource management, energy efficient communications, multi-objective optimization theory, and network topology design.

**Senior Lecturer, Communication Systems**

Jan 2016 – Nov 2017

*Linköping University, Linköping, Sweden.*

I was employed as Senior Lecturer, which is an associate professor position with tenure (called *universitet-slektor* in Swedish) at Linköping University. I worked at the Department of Electrical Engineering (ISY) with research, undergraduate teaching, and supervision of doctoral students.

**Research Fellow, Communication Systems**

Jan 2014 – Dec 2015

*Linköping University, Linköping, Sweden.*

I was employed as *Research Fellow*, which is an assistant professor position (called *biträdande universitetslektor* in Swedish) in the tenure-track at Linköping University. I worked at the Department of Electrical Engineering (ISY) with research, undergraduate teaching, and supervision of doctoral students.

**Post-Doc, Alcatel-Lucent Chair on Flexible Radio**

Sep 2012 – July 2014

*Ecole supérieure d'électricité (SUPELEC), Gif-sur-Yvette, France.*

I conducted postdoctoral research within the topic “Optimization of Green Small-Cell Telecommunication Networks”. I was sponsored by an International Postdoc Grant that I received from the Swedish Research Council (Vetenskapsrådet). Main hosts at SUPELEC: Mérouane Debbah and Marios Kountouris.

**Post-Doc, Signal Processing Lab, School of Electrical Engineering**

Dec 2011 – July 2014

*KTH Royal Institute of Technology, Stockholm, Sweden.*

The first part (until Sept. 2012) consisted of independent research on “Optimal Resource Allocation in Coordinated Multi-Cell Systems” and resulted in a scientific book with that title. During the second part (Sept. 2012 to July 2014), KTH served as my Swedish “home university” for the international postdoc grant “Optimization of Green Small-Cell Telecommunication Networks” from the Swedish Research Council (Vetenskapsrådet). The postdoc research was conducted at SUPELEC, France.

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## EDUCATIONAL EXPERIENCE

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**Docent Title**

I received the Docent title from Linköping University in Feb. 2015. This is the second highest grade in the Swedish academic system, and the docent title is required to be main supervisor of doctoral students.

**Courses in Teaching**

- “*Research supervision – Advanced Course in Higher Education Pedagogy*” (4 credits), Linköping University.
- “*Basic Communication and Teaching*” (3 credits) and “*Learning and Teaching*” (7.5 credits), KTH.

**Teaching Experience**

I am currently course director, examiner, and lecturer in the following courses at Linköping University:

- *TSKS01 Digital Communication* (2015-), Master level.
- *TSKS14 Multiple Antenna Coomunications* (2017-), Master level.

I have previously been involved in the following courses:

- *TSRT04 Introduction in Matlab* (2014-2017), Bachelor level, course director, lecturer.
- *Multiuser MIMO and Spatial Resource Allocation* (2017), PhD level, course director, lecturer.
- *TSKS04 Digital Communication Continuation Course* (2015-2016), Master level, course director, lecturer
- *Fundamentals of Massive MIMO* (2016), PhD level, lecturer.
- *TSKS02 Telecommunication* (2014), Bachelor level, course director,lecturer.
- *Matrix Algebra* (2012), PhD level, lecturer.

- *Signal Theory and Signals and Systems II* (2007–2010), Master and Bachelor level, teaching assistant.
- *Signals and Communications* (2006), Bachelor level, teaching assistant and course development.
- *Calculus in One Variable, Calculus in Several Variables, Linear Algebra, and Computational methods* (2003–2006), Bachelor level, teaching assistant and exam correction.

I have supervised and acted as examiner on several Master's degree projects:

- 2015-2017: Examiner of four Master's degree projects, Linköping University.
- 2008-2009: Supervisor for two Master's degree projects, KTH.

### Research Supervision

I am currently main supervisor of two doctoral students at Linköping University:

- Trinh Van Chien, since March 2015.
- Daniel Verenzuela, since April 2015.
- Amin Ghazanfari, since July 2017.
- Özdogan Özgecan, since August 2017.

I am currently assistant supervisor of three doctoral students at Linköping University:

- Marcus Karlsson, since January 2015.
- Hei Victor Cheng, since January 2015.
- Ema Becirovic, since August 2017.

I have previously been an assistant supervisor of

- Dr. Antonios Pitarokoilis, graduated in June 2016, Linköping University.
- Dr. Axel Müller, graduated in November 2014, SUPELEC.

I have acted as advisor for the following postdocs at Linköping University:

- Salil Kashyap 2014-2016.
- Julia Vinogradova, 2015-2016.
- Tan Tai Do, 2016.
- Zheng Chen, 2017-.
- Kamil Senel, 2017-.

### Teaching Material

- Emil Björnson, Jakob Hoydis, Luca Sanguinetti, "*Massive MIMO Networks: Spectral, Energy, and Hardware Efficiency*" (517 pages), published in the book series Foundations and Trends® in Signal Processing, 2017. This book is suitable as course material for graduate and doctoral students. A package with slides and homework problems are offered to teachers.
- Emil Björnson, Eduard Jorswieck, "*Optimal Resource Allocation in Coordinated Multi-Cell Systems*" (270 pages), published in the book series Foundations and Trends® in Communications and Information Theory, 2013. This book is suitable as course material for doctoral students.
- Mikael Olofsson, Emil Björnson, "*Introduction to Digital Communication*" (200 pages), published locally at Linköping University. This book is used in the Master course TSKS01 *Digital Communication*.
- I have produced course material for multiple three-hour tutorials at international conferences: IEEE PIMRC 2013, IEEE ICC 2014, IEEE ICC 2015, IEEE SPAWC 2015, GLOBECOM 2016. This material consists of detailed slides with overview material, suitable for doctoral students.

### Leadership in Educational Programmes

Since 2016 I am the director of the Master's programme in Communication Systems and the director of the Communication profile for Swedish engineering students at Linköping University. I have proposed and implemented a major modernization of the course curriculum, effective from 2017.

# SCIENTIFIC EXPERIENCE

## Research Grants

- *Jan 2016 - Dec 2019*: I have received funding from the Swedish Research Council (VR) for the project “*Optimized Design of Wireless Networks with Multiple Performance Metrics*”.
- *Sept 2015 - Aug 2018*: I have received the 2015 Ingvar Carlsson Award from the Swedish Foundation for Strategic Research (SFF) for the project “*Holistic energy efficiency optimization in cellular networks*”.
- *Jan 2015 - Dec 2017*: I have received funding from CENIIT for the project “*Radio Resource Management in Massive MIMO Communication Systems*”.
- *Sept 2012 - July 2014*: I was one of the first recipients of the International Postdoc Grant from the Swedish Research Council (VR). This grant funded a 2-year postdoc position at SUPELEC, France.

## Inventions

I am a co-inventor in 13 patent applications related to multi-antenna communication technology. 4 applications were filed in 2017, 7 applications were filed in 2016, and 2 applications were filed in 2015. These inventions have been made in collaboration with Ericsson Research.

## Scientific Publications

I have published the following (and additional papers are under review):

- 2 scientific books and 1 book chapter
- 5 overview articles
- 52 international journal articles
- 93 conference papers

These publications have received 4478 citations, whereof one article has 361 citations and my first book has 225 citations. These citations correspond to an *h*-index of 31 (source: [Google Scholar](https://scholar.google.com/), 9 Apr 2018).

## Open and Reproducible Research

I am an active promoter of reproducibility of research results and of open publishing. I have made simulation code freely and publically available for more than 20 scientific publications, including my books from 2013 and 2017. Most of the code is available here: <https://github.com/emilbjornson>

## Editor in International Journals

- I have been an associate editor of *IEEE Transactions on Communications* since 2017.
- I have been an associate editor of *IEEE Transactions on Green Communications and Networking* since it was founded in 2016. I was an associate editor of the *IEEE Journal on Selected Areas in Communications (JSAC)*, series on *Green Communications and Networking*, 2015-2016.
- I was a guest editor for the two-part special issue on Millimeter Wave Communications For Future Mobile Networks, *IEEE Journal on Selected Areas in Communications*, 2017

## Involvement in International Research Projects

- I acted as work package leader for WP1 in the European project 5Gwireless (H2020 Marie Skłodowska-Curie Innovative Training Networks (ITNs)), 2015-2018.
- I was a task leader for T1.1 and T3.1 in the European project MAMMOET (FP7), 2014-2016.
- Many of my research papers are published within European research projects: METIS (FP7), MORE (ERC), HIATUS (FP7), AMIMOS (ERC), COOPCOM (FP6), and WINNER+ (Celtic).

## Invited and Tutorial Speeches (selection)

- Webinar speaker in the IEEE 5G Webinar Series, January 17, 2018.
- Tutorial speaker at the IEEE Global Communications Conference (GLOBECOM), Singapore, De-

ember 2017.

- Invited speaker in the workshop 5G Heterogeneous and Small Cell Networks, IEEE Global Communications Conference (GLOBECOM), Singapore, December 2017.
- Webinar speaker in the IEEE ComSoc Webinar Series, November 9, 2017.
- Lecturer at the 2017 Joint IEEE SPS and EURASIP Summer School on Signal Processing for 5G Wireless Access, May 2017.
- Tutorial speaker at the IEEE Global Communications Conference (GLOBECOM), Washington D.C., USA, December 2016.
- Tutorial speaker at the 5Gwireless Training Event, Dresden, Germany, September 2016.
- Tutorial speaker at the Tyrrhenian International Workshop on Digital Communications, Livorno, Italy, September 2016.
- Tutorial speaker at the IEEE Workshop on Signal Processing Advances in Wireless Communications (SPAWC), Stockholm, Sweden, June 2015.
- Tutorial speaker at the IEEE International Conference on Communications (ICC), London, UK, June 2015.
- Keynote speaker at International Workshop on Computer-Aided Modeling Analysis and Design of Communication Links and Networks (CAMAD), Athens, Greece, December 2014.
- Lecturer at 5GrEEEn Summer School on “Energy Efficient Mobile Networks”, Stockholm, Sweden, August 2014.
- Tutorial speaker at the IEEE International Conference on Communications (ICC), Sydney, Australia, June 2014.
- Keynote speaker at the Workshop on Wireless Evolution Beyond 2020, Istanbul, Turkey, April 2014.
- Lecturer at Newcom# Spring School on “Advanced Signal Processing Techniques for Heterogeneous Networks”, Pisa, Italy, March 2014.
- Invited speaker at Greentouch Open Forum, Paris, France, November 2013.
- Tutorial speaker at the IEEE Symposium on Personal, Indoor, Mobile and Radio Communications (PIMRC), London, UK, September 2013.
- Keynote speaker at the workshop “Signal Processing and Optimization for Wireless Communications: In Memory of Are Hjørungnes”, Trondheim, Norway, May 2013.

### **Popular Science Activities**

- I wrote an article “Wireless Communication Goes Massive: Massive MIMO for 5G” in the Maxwell Future, Issue 21.1, 2017.
- I gave a video interview with the Swedish website Fjärde uppgiften in September 2017. The video is called “Linköping har en viktig roll i morgondagens mobilsystem” and is available on Youtube.
- I gave a talk about “Claude Shannon 100 year: From information theory to information technology” at the Science Day for high school teachers, Linköping, October 2016.
- I wrote an article about “10 myths on Massive MIMO” in Elektroniktidningen, February 2016.
- I gave several talks about future cellular networks at the Science Day for high school teachers and during the Popular Science week for high school students, Linköping, October 2015.
- I gave an interview on the Swedish radio (P4 Östergötland) about “5G versus fiber”, September 2015.

### **Committees and Organization**

- I am a member of the Signal Processing for Communications and Networking Technical Committee (SPCOM-TC), 2017-.
- I serve as Track Chair of the MIMO Communications and Signal Processing track at the 52nd Annual Asilomar Conference on Signals, Systems, and Computers, October 28-31, 2018.

- I served as the Technical Program Chair of the 2017 Joint IEEE SPS and EURASIP Summer School on Signal Processing for 5G Wireless Access, May 29 - June 1, Gothenburg, Sweden, 2017.
- I co-organized the Massive MIMO Communications Symposium at IEEE Global Conference on Signal and Information Processing (GlobalSIP), December 3-5, Atlanta, Georgia, 2014.
- I served as a Vice-Chair of Local Arrangements at IEEE Swedish Communication Technologies Workshop (Swe-CTW), October 19-21, Stockholm, Sweden, 2011.
- I have been a member of Technical Program Committees at the conferences GLOBECOM 2014-2017, ICC 2015-2017, ICC 2013-2014, PIMRC 2013, 2016-2017, SPAWC 2017, WCSP 2012-2014, and WCNC 2015-2017.
- I have acted as session chair at the conferences ICC (2014, 2016, 2017), GLOBECOM (2012, 2015), GlobalSIP (2014), PIMRC (2013), and VTC-Spring (2015).

#### **Assignments as Scientific Expert**

- Examiner of the doctoral dissertation by Stefan Dierks, TU München, Germany (February 2018).
- Faculty opponent of the doctoral dissertation by Johan Swärd, Lund University, Sweden (September 2017).
- Faculty opponent of the licentiate dissertation by Demia Della Penda, KTH Royal Institute of Technology, Sweden (March 2016).
- Faculty opponent of the doctoral dissertation by Janis Werner, Tampere University of Technology, Finland (November 2015).
- Member of 2015 review panel on “Signal and image processing and acoustics”, Academy of Finland.

#### **Reviewer in International Journals and Conferences**

- I am a recurring reviewer of journal articles in IEEE Transactions on Signal Processing, IEEE Transactions on Wireless Communications, IEEE Transactions on Communications, IEEE Transactions on Vehicular Technology, IEEE Access, IEEE Communication Magazine, IEEE Communications Letters, and IEEE Signal Processing Letters. I have received recognition as an Exemplary Reviewer several times (see below).
- I am a recurring reviewer of papers at high-quality international IEEE conferences such as GLOBECOM, ICC, PIMRC, SPAWC, VTC and WCNC.

## **HONORS & AWARDS**

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**Senior Member of the Institute of Electrical and Electronics Engineers (IEEE)**, elevated in November 2017.

**Best Paper Award (third author):** 2017 International Conference on Wireless Communications and Signal Processing (WCSP) for work on cell-free massive MIMO.

**Exemplary Reviewer in IEEE Transaction on Wireless Communications:** Selected in 2017.

**2017 IEEE Sweden VT-COM-IT Joint Chapter Best Student Journal Paper Award (second author):** Awarded to Jingya Li for the paper “Joint Precoding and Load Balancing Optimization for Energy-Efficient Heterogeneous Networks”.

**2016 EURASIP Best PhD Award:** The European Signal Processing Association as selected my PhD thesis for this award, which is given at EUSIPCO 2016.

**2015 Ingvar Carlsson Award:** I was selected by the Swedish Foundation for Strategic Research to a competitive programme that gives homecoming postdocs funding to launch their own independent and

creative research careers in Sweden.

**Best Paper Award (second author):** 2015 IEEE International Conference on Communications (ICC), for work on load balancing and precoding in cellular networks.

**2014 IEEE ComSoc Outstanding Young Researcher:** Awarded by the IEEE ComSoc EMEA Region Committee for “promising research activities for the benefit of the society”.

**Best Paper Award (first author):** 2014 IEEE Wireless Communications and Networking Conference (WCNC), for work on energy efficiency and massive MIMO communications.

**Best Student Paper Award (third author, 2nd prize):** 2014 IEEE Sensor Array and Multichannel Signal Processing Workshop (SAM), for work on massive MIMO communications.

**Exemplary Reviewer in IEEE Transaction on Communications:** Selected in 2014 and 2015.

**Exemplary Reviewer in IEEE Communications Letters:** Selected three years in a row: 2012-2014.

**Best Student Paper Award (first author):** 2011 IEEE International Workshop on Computational Advances in Multi-Sensor Adaptive Processing (CAMSAP) for work on precoding in cellular networks.

**Best Paper Award (first author):** 2009 International Conference on Wireless Communications and Signal Processing (WCSP) for work on cooperative multicell and multiantenna communication.

**Guest Researcher:** Received grant as guest researcher at the Department of Signals and Systems (S2), Chalmers University of Technology, Sweden, in the Spring 2013.

**Travel Scholarships:** Received several competitive scholarships for participating in scientific conferences during the doctoral studies (awarded from Ericsson Research Foundation and from Pleijel-fonden).

**2006 DigSigProject Challenge:** First place in course competition on programming for DSP cards, during Master of Science studies. Texas Instruments sponsored the competition.

**2005 Algorithm Implementation Course Competition:** First place in course competition on efficient programming, during Master of Science studies.

## SCIENTIFIC PUBLICATIONS

### Scientific Books and Book Chapters

[B3] Emil Björnson, Jakob Hoydis, Luca Sanguinetti, “*Massive MIMO Networks: Spectral, Energy, and Hardware Efficiency*,” Foundations and Trends® in Signal Processing: vol. 11, no. 3-4, pp. 154–655, 2017. (Supplementary Matlab code is available with DOI: [10.1561/20000000093\\_supp](https://doi.org/10.1561/20000000093_supp))

[B2] Trinh Van Chien, Emil Björnson, “*Massive MIMO Communications*,” in 5G Mobile Communications, W. Xiang et al. (eds.), pp. 77-116, Springer, 2017.

[B1] Emil Björnson, Eduard Jorswieck, “*Optimal Resource Allocation in Coordinated Multi-Cell Systems*,” Foundations and Trends® in Communications and Information Theory, vol. 9, no. 2-3, pp. 113-381, 2013. (Supplementary Matlab code is available with DOI: [10.1561/01000000069\\_supp](https://doi.org/10.1561/01000000069_supp))

### Overview Articles

[A5] Ming Xiao, Shahid Mumtaz, Yongming Huang, Linglong Dai, Yonghui Li, Michail Matthaiou,

George K. Karagiannidis, Emil Björnson, Kai Yang, Chih-Lin I, Amitabha Ghosh, “*Millimeter Wave Communications for Future Mobile Networks*,” IEEE Journal on Selected Areas in Communications, vol. 35, no. 9, September 2017.

[A4] Elisabeth de Carvalho, Emil Björnson, Jesper H. Sørensen, Petar Popovski, Erik G. Larsson, “*Random Access Protocols for Massive MIMO*,” IEEE Communications Magazine, vol. 55, no. 5, pp. 216-222, May 2017.

[A3] Emil Björnson, Erik G. Larsson, Thomas L. Marzetta, “*Massive MIMO: Ten Myths and One Critical Question*,” IEEE Communications Magazine, vol. 54, no. 2, pp. 114-123, February 2016.

[A2] Emil Björnson, Eduard Jorswieck, Mérouane Debbah, Björn Ottersten, “*Multi-Objective Signal Processing Optimization: The Way to Balance Conflicting Metrics in 5G Systems*,” IEEE Signal Processing Magazine (Special Issue on Signal Processing for the 5G Revolution), vol. 31, no. 6, pp. 14-23, November 2014.

[A1] Emil Björnson, Mats Bengtsson, Björn Ottersten, “*Optimal Multi-User Transmit Beamforming: A Difficult Problem with a Simple Solution Structure*,” IEEE Signal Processing Magazine, vol. 31, no. 4, pp. 142-148, July 2014.

### Journal Articles

[J52] Chuili Kong, Caijun Zhong, Michail Matthaiou, Emil Björnson, Zhaoyang Zhang, “*Multipair Two-Way Half-Duplex DF Relaying with Massive Arrays and Imperfect CSI*,” IEEE Transactions on Wireless Communications, To appear.

[J51] Trinh Van Chien, Emil Björnson, Erik G. Larsson, “*Joint Pilot Design and Uplink Power Allocation in Multi-Cell Massive MIMO Systems*,” IEEE Transactions on Wireless Communications, To appear.

[J50] Orod Raeesi, Ahmet Gokceoglu, Yaning Zou, Emil Björnson, Mikko Valkama, “*Performance Analysis of Multi-User Massive MIMO Downlink under Channel Non-Reciprocity and Imperfect CSI*,” IEEE Transactions on Communications, To appear.

[J49] Marcus Karlsson, Emil Björnson, Erik G. Larsson, “*Performance of In-band Transmission of System Information in Massive MIMO Systems*,” IEEE Transactions on Wireless Communications, To appear.

[J48] Hossein Akhlaghpasand, S. Mohammad Razavizadeh, Emil Björnson, Tan Tai Do, “*Jamming Detection in Massive MIMO Systems*,” IEEE Wireless Communications Letters, To appear.

[J47] Meysam Sadeghi, Emil Björnson, Erik G. Larsson, Chau Yuen, Thomas L. Marzetta, “*Max-Min Fair Transmit Precoding for Multi-group Multicasting in Massive MIMO*,” IEEE Transactions on Wireless Communications, To appear.

[J46] M. M. Aftab Hossain, Cicek Cavdar, Emil Björnson, Riku Jäntti, “*Energy Saving Game for Massive MIMO: Coping with Daily Load Variation*,” IEEE Transactions on Transactions on Vehicular Technology, To appear.

[J45] Jiayi Zhang, Xipeng Xue, Emil Björnson, Bo Ai, Shi Jin, “*Spectral Efficiency of Multipair Massive MIMO Two-Way Relaying with Hardware Impairments*,” IEEE Wireless Communications Letters, vol. 7, no. 1, pp. 14-17, Feb. 2018.

[J44] Emil Björnson, Jakob Hoydis, Luca Sanguinetti, “*Massive MIMO Has Unlimited Capacity*,” IEEE Transactions on Wireless Communications, vol. 17, no. 1, pp. 574-590, Jan. 2018.

[J43] Hei Victor Cheng, Emil Björnson, Erik G. Larsson, “*Performance Analysis of NOMA in Training Based Multiuser MIMO Systems*,” IEEE Transactions on Wireless Communications, vol. 17, no. 1, pp. 372-385, Jan. 2018.

[J42] Tan Tai Do, Emil Björnson, Erik G. Larsson, “*Jamming-Resistant Receivers for the Massive MIMO Uplink*,” IEEE Transactions on Information Forensics & Security, vol. 13, no. 1, pp. 210-223, Jan. 2018.



- [J41] Elisabeth de Carvalho, Emil Björnson, Jesper H. Sørensen, Erik G. Larsson, Petar Popovski, “*Random Pilot and Data Access in Massive MIMO for Machine-type Communications*,” IEEE Transactions on Wireless Communications, vol. 16, no. 12, pp. 7703-7717, Dec. 2017.
- [J40] Marcus Karlsson, Emil Björnson, Erik G. Larsson, “*Jamming a TDD Point-to-Point Link Using Reciprocity-Based MIMO*,” IEEE Transactions on Information Forensics & Security, vol. 12, no. 12, pp. 2957-2970, Dec. 2017.
- [J39] Xueru Li, Emil Björnson, Erik G. Larsson, Shidong Zhou, Jing Wang, “*Massive MIMO with Multi-cell MMSE Processing: Exploiting All Pilots for Interference Suppression*,” EURASIP Journal on Wireless Communications and Networking, 2017:117, June 2017.
- [J38] Alessio Zappone, Emil Björnson, Luca Sanguinetti, Eduard Jorswieck, “*Achieving Global Optimality for Energy Efficiency Maximization in Wireless Networks*,” IEEE Transactions on Signal Processing, vol. 65, no. 11, pp. 2844-2859, June 2017.
- [J37] Emil Björnson, Elisabeth de Carvalho, Jesper H. Sørensen, Erik G. Larsson, Petar Popovski, “*A Random Access Protocol for Pilot Allocation in Crowded Massive MIMO Systems*,” IEEE Transactions on Wireless Communications, vol. 16, no. 4, pp. 2220-2234, April 2017.
- [J36] Hei Victor Cheng, Emil Björnson, Erik G. Larsson, “*Optimal Pilot and Payload Power Control in Single-Cell Massive MIMO Systems*,” IEEE Transactions on Signal Processing, vol. 65, no. 9, pp. 2363-2378, May 2017.
- [J35] Ahmet Gokceoglu, Emil Björnson, Erik G. Larsson, Mikko Valkama, “*Spatio-Temporal Waveform Design for Multiuser Massive MIMO Downlink With 1-bit Receivers*,” IEEE Journal of Selected Topics in Signal Processing, vol. 11, no. 2, pp. 347-362, March 2017.
- [J34] Jiayi Zhang, Linglong Dai, Xinling Zhang, Emil Björnson, Zhaocheng Wang, “*Achievable Rate of Rician Large-Scale MIMO Channels with Transceiver Hardware Impairments*,” IEEE Transactions on Vehicular Technology, vol. 65, no. 10, pp. 8800-8806, October 2016.
- [J33] Trinh Van Chien, Emil Björnson, Erik G. Larsson, “*Joint Power Allocation and User Association Optimization for Massive MIMO Systems*,” IEEE Transactions on Wireless Communications, vol. 15, no. 9, pp. 6384-6399, September 2016.
- [J32] Antonios Pitarokoilis, Emil Björnson, Erik G. Larsson, “*Performance of the Massive MIMO Uplink with OFDM and Phase Noise*,” IEEE Communications Letters, vol. 20, no. 8, pp. 1595-1598, August 2016.
- [J31] Rami Mochaourab, Emil Björnson, Mats Bengtsson, “*Adaptive Pilot Clustering in Heterogeneous Massive MIMO Networks*,” IEEE Transactions on Wireless Communications, vol. 15, no. 8, pp. 5555-5568, August 2016.
- [J30] Serveh Shalmashi, Emil Björnson, Marios Kountouris, Ki Won Sung, Mérouane Debbah, “*Energy Efficiency and Sum Rate Tradeoffs for Massive MIMO Systems with Underlaid Device-to-Device Communications*,” EURASIP Journal on Wireless Communications and Networking, 2016:175, 2016.
- [J29] Axel Müller, Abla Kammoun, Emil Björnson, Mérouane Debbah, “*Linear Precoding Based on Polynomial Expansion: Reducing Complexity in Massive MIMO*,” EURASIP Journal on Wireless Communications and Networking, 2016:63, 2016.
- [J28] Salil Kashyap, Emil Björnson, Erik G. Larsson, “*On the Feasibility of Wireless Energy Transfer Using Massive Antenna Arrays*,” IEEE Transactions on Wireless Communications, vol. 15, no. 5, pp. 3466-2480, May 2016.
- [J27] Emil Björnson, Luca Sanguinetti, Marios Kountouris, “*Deploying Dense Networks for Maximal Energy Efficiency: Small Cells Meet Massive MIMO*,” IEEE Journal on Selected Areas in Communications, vol. 34, no. 4, pp. 832-847, April 2016.
- [J26] Hessam Pirzadeh, S. Mohammad Razavizadeh, Emil Björnson, “*Subverting Massive MIMO by Smart Jamming*,” IEEE Wireless Communications Letters, vol. 5, no. 1, pp. 20-23, February 2016.

- [J25] Emil Björnson, Erik G. Larsson, Mérouane Debbah, “*Massive MIMO for Maximal Spectral Efficiency: How Many Users and Pilots Should Be Allocated?*,” IEEE Transactions on Wireless Communications, vol. 15, no. 2, pp. 1293-1308, February 2016.
- [J24] Antonios Pitarokoilis, Emil Björnson, Erik G. Larsson, “*ML Detection in Phase Noise Impaired SIMO Channels with Uplink Training*,” IEEE Transactions on Communications, vol. 64, no. 1, pp. 223-235, January 2016.
- [J23] Xueru Li, Shidong Zhou, Emil Björnson, Jing Wang, “*Capacity Analysis for Spatially Non-Wide Sense Stationary Uplink Massive MIMO Systems*,” IEEE Transactions on Wireless Communications, vol. 14, no. 12, pp. 7044-7056, December 2015.
- [J22] Jingya Li, Emil Björnson, Tommy Svensson, Thomas Eriksson, Mérouane Debbah, “*Joint Precoding and Load Balancing Optimization for Energy-Efficient Heterogeneous Networks*,” IEEE Transactions on Wireless Communications, vol. 14, no. 10, pp. 5810-5822, October 2015. **Recipient of 2017 IEEE Sweden VT-COM-IT Joint Chapter Best Student Journal Paper Award.**
- [J21] Xinlin Zhang, Michail Matthaiou, Emil Björnson, Mikael Coldrey, “*Impact of residual transmit RF impairments on training-based MIMO systems*,” IEEE Transactions on Communications, vol. 63, no. 8, pp. 2899-2911, August 2015.
- [J20] Axel Müller, Romain Couillet, Emil Björnson, Sebastian Wagner, Mérouane Debbah, “*Interference-Aware RZF Precoding for Multi-Cell Downlink Systems*,” IEEE Transactions on Signal Processing, vol. 63, no. 15, pp. 3959-3973, August 2015.
- [J19] Emil Björnson, Michail Matthaiou, Mérouane Debbah, “*Massive MIMO with Arbitrary Non-Ideal Arrays: Hardware Scaling Laws and Circuit-Aware Design*,” IEEE Transactions on Wireless Communications, vol. 14, no. 8, pp. 4353-4368, August 2015.
- [J18] Emil Björnson, Luca Sanguinetti, Jakob Hoydis, Mérouane Debbah, “*Optimal Design of Energy-Efficient Multi-User MIMO Systems: Is Massive MIMO the Answer?*,” IEEE Transactions on Wireless Communications, vol. 14, no. 6, pp. 3059-3075, June 2015.
- [J17] Mikko Vehkaperä, Taneli Riihonen, Maksym Girnyk, Emil Björnson, Mérouane Debbah, Lars K. Rasmussen, Risto Wichman, “*Asymptotic Analysis of MIMO Channels With Transmitter Noise and Mismatched Decoding*,” IEEE Transactions on Communications, vol. 63, no. 3, pp. 749-765, March 2015.
- [J16] Luca Sanguinetti, Aris L. Moustakas, Emil Björnson, Mérouane Debbah “*Large System Analysis of the Energy Consumption Distribution in Multi-User MIMO Systems with Mobility*,” IEEE Transactions on Wireless Communications, vol. 14, no. 3, pp. 1730-1745, March 2015.
- [J15] Emil Björnson, Jakob Hoydis, Marios Kountouris, and Mérouane Debbah, “*Massive MIMO Systems with Non-Ideal Hardware: Energy Efficiency, Estimation, and Capacity Limits*,” IEEE Transactions on Information Theory, vol. 60, no. 11, pp. 7112-7139, November 2014.
- [J14] Abba Kammoun, Axel Müller, Emil Björnson, Mérouane Debbah, “*Linear Precoding Based on Polynomial Expansion: Large-Scale Multi-Cell MIMO Systems*,” IEEE Journal of Selected Topics in Signal Processing, vol. 8, no. 5, pp. 861-875, October 2014.
- [J13] Nafiseh Shariati, Emil Björnson, Mats Bengtsson, Mérouane Debbah, “*Low-Complexity Polynomial Channel Estimation in Large-Scale MIMO with Arbitrary Statistics*,” IEEE Journal of Selected Topics in Signal Processing, vol. 8, no. 5, pp. 815-830, October 2014.
- [J12] Emil Björnson, Michail Matthaiou, Mérouane Debbah, “*A New Look at Dual-Hop Relaying: Performance Limits with Hardware Impairments*,” IEEE Transactions on Communications, vol. 61, no. 11, pp. 4512-4525, November 2013.
- [J11] Dimitrios Katselis, Cristian Rojas, Mats Bengtsson, Emil Björnson, Xavier Bombois, Nafiseh Shariati, Magnus Jansson, Håkan Hjalmarsson, “*Training sequence design for MIMO channels: an application-oriented approach*,” EURASIP Journal on Wireless Communications and Networking, 2013:245, 2013.

- [J10] Emil Björnson, Marios Kountouris, Mats Bengtsson, Björn Ottersten, “*Receive Combining vs. Multi-Stream Multiplexing in Downlink Systems with Multi-Antenna Users*,” IEEE Transactions on Signal Processing, vol. 61, no. 13, pp. 3431-3446, July 2013.
- [J9] Michail Matthaiou, Agisilaos Papadogiannis, Emil Björnson, and Mérouane Debbah, “*Two-way Relaying under the Presence of Relay Transceiver Hardware Impairments*,” IEEE Communications Letters, vol. 17, no. 6, pp. 1136-1139, June 2013.
- [J8] Emil Björnson, Per Zetterberg, Mats Bengtsson, Björn Ottersten, “*Capacity Limits and Multiplexing Gains of MIMO Channels with Transceiver Impairments*,” IEEE Communications Letters, vol. 17, no. 1, pp. 91-94, January 2013.
- [J7] Emil Björnson, Mats Bengtsson, Björn Ottersten, “*Pareto Characterization of the Multicell MIMO Performance Region With Simple Receivers*,” IEEE Transactions on Signal Processing, vol. 60, no. 8, pp. 4464-4469, August 2012.
- [J6] Emil Björnson, Gan Zheng, Mats Bengtsson, Björn Ottersten, “*Robust Monotonic Optimization Framework for Multicell MISO Systems*,” IEEE Transactions on Signal Processing, vol. 60, no. 5, pp. 2508-2523, May 2012.
- [J5] Emil Björnson, Niklas Jaldén, Mats Bengtsson, Björn Ottersten, “*Optimality Properties, Distributed Strategies, and Measurement-Based Evaluation of Coordinated Multicell OFDMA Transmission*” IEEE Transactions on Signal Processing, vol. 59, no. 12, pp. 6086-6101, December 2011.
- [J4] Emil Björnson, Eduard Jorswieck, Björn Ottersten, “*Impact of Spatial Correlation and Precoding Design in OSTBC MIMO Systems*,” IEEE Transactions on Wireless Communications, vol. 9, no. 11, pp. 3578-3589, November 2010.
- [J3] Emil Björnson, Randa Zakhour, David Gesbert, Björn Ottersten, “*Cooperative Multicell Precoding: Rate Region Characterization and Distributed Strategies with Instantaneous and Statistical CSI*,” IEEE Transactions on Signal Processing, vol. 58, no. 8, pp. 4298-4310, August 2010.
- [J2] Emil Björnson, Björn Ottersten, “*A Framework for Training-Based Estimation in Arbitrarily Correlated Rician MIMO Channels with Rician Disturbance*,” IEEE Transactions on Signal Processing, vol. 58, no. 3, pp. 1807-1820, March 2010.
- [J1] Emil Björnson, David Hammarwall, Björn Ottersten, “*Exploiting Quantized Channel Norm Feedback through Conditional Statistics in Arbitrarily Correlated MIMO Systems*,” IEEE Transactions on Signal Processing, vol. 57, no. 10, pp. 4027-4041, October 2009.

## Conference Papers

- [C93] Noman Akbar, Emil Björnson, Erik G. Larsson, Nan Yang, “*Downlink Power Control in Massive MIMO Networks with Distributed Antenna Arrays*,” IEEE International Conference on Communications (ICC), Kansas City, USA, May 2017.
- [C92] Kamil Senel, Emil Björnson, Erik G. Larsson, “*Human and Machine Type Communications can Coexist in Uplink Massive MIMO Systems*,” Proceedings of IEEE Conference on Acoustics, Speech, and Signal Processing (ICASSP), Calgary, Canada, April 2018.
- [C91] Hei Victor Cheng, Emil Björnson, Erik G. Larsson, “*Semi-Closed Form Solution For Sum Rate Maximization in Downlink Multiuser MIMO via Large-System Analysis*” Proceedings of IEEE Conference on Acoustics, Speech, and Signal Processing (ICASSP), Calgary, Canada, April 2018.
- [C90] Meysam Sadeghi, Emil Björnson, Erik G. Larsson, Chau Yuen, Thomas Marzetta, “*MRT-Based Joint Unicast and Multigroup Multicast Transmission in Massive MIMO Systems*,” Proceedings of IEEE Conference on Acoustics, Speech, and Signal Processing (ICASSP), Calgary, Canada, April 2018.
- [C89] Kamil Senel, Emil Björnson, Erik G. Larsson “*Adapting the Number of Antennas and Power to Traffic*

- Load: When to Turn on Massive MIMO?*” Proceedings of IEEE Wireless Communications and Networking Conference (WCNC), Barcelona, Spain, April 2018.
- [C88] Trinh Van Chien, Emil Björnson, Erik G. Larsson, Tuan Anh Le, “*Distributed Power Control in Downlink Cellular Massive MIMO Systems*,” Proceedings of ITG Workshop on Smart Antennas (WSA), Bochum, Germany, March 2018.
- [C87] Amin Ghazanfari, Emil Björnson, Erik G. Larsson, “*Power Control for D2D Underlay in Multi-cell Massive MIMO Networks*,” Proceedings of ITG Workshop on Smart Antennas (WSA), Bochum, Germany, March 2018.
- [C86] Mohammed Zahid Aslam, Yoann Corre, Emil Björnson, Yves Lostanlen, “*Massive MIMO Channel Performance Analysis Considering Separation of Simultaneous Users*,” Proceedings of ITG Workshop on Smart Antennas (WSA), Bochum, Germany, March 2018.
- [C85] Zheng Chen, Emil Björnson, “*Can We Rely on Channel Hardening in Cell-Free Massive MIMO?*” Proceedings of IEEE Global Communications Conference (GLOBECOM), International Workshop on Large-Scale Antenna Systems in Licensed and Unlicensed Bands, Singapore, December 2017.
- [C84] Daniel Verenzuela, Emil Björnson, Luca Sanguinetti, “*Joint UL and DL Spectral Efficiency Optimization of Superimposed Pilots in Massive MIMO*,” Proceedings of IEEE Global Communications Conference (GLOBECOM), International Workshop on Large-Scale Antenna Systems in Licensed and Unlicensed Bands, Singapore, December 2017.
- [C83] Kamil Senel, Emil Björnson, Erik G. Larsson “*Optimal Base Station Design with Limited Fronthaul: Massive Bandwidth or Massive MIMO?*” Proceedings of IEEE Global Communications Conference (GLOBECOM), International Workshop on Large-Scale Antenna Systems in Licensed and Unlicensed Bands, Singapore, December 2017.
- [C82] Daniel Verenzuela, Emil Björnson, Luca Sanguinetti, “*Spectral Efficiency of Superimposed Pilots in Uplink Massive MIMO Systems*,” Proceedings of IEEE Global Communications Conference (GLOBECOM), Singapore, December 2017.
- [C81] Andrea Pizzo, Daniel Verenzuela, Luca Sanguinetti, Emil Björnson, “*Network Deployment for Maximal Energy Efficiency in Uplink with Zero-Forcing*,” Proceedings of IEEE Global Communications Conference (GLOBECOM), Singapore, December 2017.
- [C80] Meysam Sadeghi, Emil Björnson, Erik G. Larsson, Chau Yuen, Thomas L. Marzetta, “*Multigroup Multicast Precoding in Massive MIMO*,” Proceedings of IEEE Global Communications Conference (GLOBECOM), Singapore, December 2017.
- [C79] Daniel Verenzuela, Emil Björnson, Michail Matthaiou, “*Per-Antenna Hardware Optimization and Mixed Resolution ADCs in Uplink Massive MIMO*,” Asilomar Conference on Signals, Systems, and Computers, Pacific Grove, USA, November 2017.
- [C78] Jiayi Zhang, Yinghua Wei, Emil Björnson, Yu Han, Xu Li, “*Spectral and Energy Efficiency of Cell-Free Massive MIMO Systems with Hardware Impairments*,” Proceedings of International Conference on Wireless Communications and Signal Processing (WCSP), Nanjing, China, November 2017. **Best Paper Award.**
- [C77] Hei Victor Cheng, Emil Björnson, Erik G. Larsson, “*NOMA in Multiuser MIMO Systems with Imperfect CSI*,” Proceedings of IEEE Workshop on Signal Processing Advances in Wireless Communications (SPAWC), Sapporo, Japan, July 2017.
- [C76] Emil Björnson, Luca Sanguinetti, Jakob Hoydis, “*Pilot Contamination is Not a Fundamental Asymptotic Limitation in Massive MIMO*,” IEEE International Conference on Communications (ICC), Paris, France, May 2017.
- [C75] Trinh Van Chien, Emil Björnson, Erik G. Larsson, “*Joint Pilot Sequence Design and Power Control for Max-Min Fairness in Uplink Massive MIMO*,” IEEE International Conference on Communications (ICC), Paris, France, May 2017.

- [C74] Antonios Pitarokoilis, Emil Björnson, Erik G. Larsson, “*On the Effect of Imperfect Timing Synchronization on Pilot Contamination*,” IEEE International Conference on Communications (ICC), Paris, France, May 2017.
- [C73] Salil Kashyap, Christopher Mollen, Emil Björnson, Erik G. Larsson, “*Performance Analysis of (TDD) Massive MIMO With Kalman Channel Prediction*,” Proceedings of IEEE Conference on Acoustics, Speech, and Signal Processing (ICASSP), New Orleans, USA, March 2017.
- [C72] Julia Vinogradova, Emil Björnson, Erik G. Larsson, “*Jamming Massive MIMO using Massive MIMO: Asymptotic Separability Results*,” Proceedings of IEEE Conference on Acoustics, Speech, and Signal Processing (ICASSP), New Orleans, USA, March 2017.
- [C71] Tan Tai Do, Emil Björnson, Erik G. Larsson, “*Jamming Resistant Receivers For Massive MIMO*,” Proceedings of IEEE Conference on Acoustics, Speech, and Signal Processing (ICASSP), New Orleans, USA, March 2017.
- [C70] Emil Björnson, Luca Sanguinetti, Mérouane Debbah, “*Massive MIMO with Imperfect Channel Covariance Information*,” Asilomar Conference on Signals, Systems, and Computers, Pacific Grove, USA, November 2016.
- [C69] Trinh Van Chien, Emil Björnson, Erik G. Larsson, “*Multi-Cell Massive MIMO Performance with Double Scattering Channels*,” IEEE International Workshop on Computer Aided Modelling and Design of Communication Links and Networks (CAMAD), Toronto, Canada, October 2016.
- [C68] Daniel Verenzuela, Emil Björnson, Michail Matthaiou, “*Hardware Design and Optimal ADC Resolution for Uplink Massive MIMO Systems*,” IEEE Sensor Array and Multichannel Signal Processing Workshop (SAM), Rio de Janeiro, Brazil, July 2016.
- [C67] Julia Vinogradova, Emil Björnson, Erik G. Larsson, “*Detection and mitigation of jamming attacks in massive MIMO systems using random matrix theory*,” Proceedings of IEEE Workshop on Signal Processing Advances in Wireless Communications (SPAWC), Edinburgh, UK, July 2016.
- [C66] Salil Kashyap, Christopher Mollén, Emil Björnson, Erik G. Larsson, “*Frequency-Domain Interpolation of the Zero-Forcing Matrix in Massive MIMO-OFDM*,” Proceedings of IEEE Workshop on Signal Processing Advances in Wireless Communications (SPAWC), Edinburgh, UK, July 2016.
- [C65] Claude Desset, Steve Blandino, Liesbet Van der Perre, Emil Björnson, Erik G. Larsson, Björn Debaillie, Andre Bourdoux, Sofie Pollin, Wim Dehaene, Ove Edfors, Liang Liu, Fredrik Tufvesson, Franz Dielacher, Javier Lorca, Eleftherios Karipidis, Klaus-Michael Koch, Tom Marzetta, “*Massive MIMO: The Scalable 5G Technology*,” Proceedings of European Conference on Networks and Communications (EU-CNC), Athens, Greece, June 2016.
- [C64] Xueru Li, Emil Björnson, Shidong Zhou, Jing Wang, “*Massive MIMO with Multi-Antenna Users: When are Additional User Antennas Beneficial?*,” Proceedings of International Conference on Telecommunications (ICT), Thessaloniki, Greece, May 2016.
- [C63] Emil Björnson, Elisabeth de Carvalho, Erik G. Larsson, Petar Popovski, “*Random Access Protocol for Massive MIMO: Strongest-User Collision Resolution (SUCR)*,” IEEE International Conference on Communications (ICC), Kuala Lumpur, Malaysia, May 2016.
- [C62] Daniel Verenzuela, Emil Björnson, Luca Sanguinetti, “*Optimal Design of Wireless Networks for Broadband Access with Minimum Power Consumption*,” IEEE International Conference on Communications (ICC), Kuala Lumpur, Malaysia, May 2016.
- [C61] Trinh Van Chien, Emil Björnson, Erik G. Larsson, “*Downlink Power Control for Massive MIMO Cellular Systems with Optimal User Association*,” IEEE International Conference on Communications (ICC), Kuala Lumpur, Malaysia, May 2016.
- [C60] Ahmet Gokceoglu, Mikko Valkama, Erik G. Larsson, Emil Björnson, “*Waveform Design for Massive MISO Downlink with Energy-Efficient Receivers Adopting 1-bit ADCs*,” IEEE International Conference on

Communications (ICC), Kuala Lumpur, Malaysia, May 2016.

[C59] Elisabeth De Carvalho, Emil Björnson, Erik G. Larsson, Petar Popovski, “*Random Access for Massive MIMO Systems with Intra-Cell Pilot Contamination,*” Proceedings of IEEE Conference on Acoustics, Speech, and Signal Processing (ICASSP), Shanghai, China, March 2016.

[C58] Julia Vinogradova, Emil Björnson, Erik G. Larsson, “*On the separability of signal and interference-plus-noise subspaces in blind pilot decontamination,*” Proceedings of IEEE Conference on Acoustics, Speech, and Signal Processing (ICASSP), Shanghai, China, March 2016.

[C57] Alessio Zappone, Emil Björnson, Luca Sanguinetti, Eduard Jorswieck, “*A Framework for Globally Optimal Energy-Efficient Resource Allocation in Wireless Networks,*” Proceedings of IEEE Conference on Acoustics, Speech, and Signal Processing (ICASSP), Shanghai, China, March 2016.

[C56] Chuili Kong, Caijun Zhong, Michail Matthaiou, Emil Björnson, Zhaoyang Zhang, “*Multi-Pair Two-Way AF Relaying Systems with Massive Arrays and Imperfect CSI,*” Proceedings of IEEE Conference on Acoustics, Speech, and Signal Processing (ICASSP), Shanghai, China, March 2016.

[C55] Emil Björnson, Erik G. Larsson, “*Three Practical Aspects of Massive MIMO: Intermittent User Activity, Pilot Synchronism, and Asymmetric Deployment,*” Proceedings of IEEE Global Communications Conference (GLOBECOM), Workshop on Massive MIMO: From theory to practice, San Diego, California, USA, December 2015.

[C54] M. M. Aftab Hossain, Cicek Cavdar, Emil Björnson, Riku Jäntti, “*Energy-Efficient Load-Adaptive Massive MIMO,*” Proceedings of IEEE Global Communications Conference (GLOBECOM), Workshop on Massive MIMO: From theory to practice, San Diego, California, USA, December 2015.

[C53] Xueru Li, Emil Björnson, Erik G. Larsson, Shidong Zhou, Jing Wang, “*A Multi-cell MMSE Detector for Massive MIMO Systems and New Large System Analysis,*” Proceedings of IEEE Global Communications Conference (GLOBECOM), San Diego, California, USA, December 2015.

[C52] Xueru Li, Emil Björnson, Erik G. Larsson, Shidong Zhou, Jing Wang, “*A Multi-cell MMSE Precoder for Massive MIMO Systems and New Large System Analysis,*” Proceedings of IEEE Global Communications Conference (GLOBECOM), San Diego, California, USA, December 2015.

[C51] Milad Fozooni, Michail Matthaiou, Emil Björnson, Trung Q. Duong, “*Performance Limits of MIMO Systems with Nonlinear Power Amplifiers,*” Proceedings of IEEE Global Communications Conference (GLOBECOM), San Diego, California, USA, December 2015.

[C50] Emil Björnson, Michail Matthaiou, Antonios Pitarokoilis, Erik G. Larsson, “*Distributed Massive MIMO in Cellular Networks: Impact of Imperfect Hardware and Number of Oscillators,*” Proceedings of European Signal Processing Conference (EUSIPCO), Nice, France, September 2015.

[C49] Hei Victor Cheng, Emil Björnson, Erik G. Larsson, “*Uplink Pilot and Data Power Control for Single Cell Massive MIMO Systems with MRC,*” Proceedings of International Symposium on Wireless Communication Systems (ISWCS), Brussels, Belgium, August 2015.

[C48] Markus Karlsson, Emil Björnson, Erik G. Larsson, “*Broadcasting in Massive MIMO Using OSTBC with Reduced Dimension,*” Proceedings of International Symposium on Wireless Communication Systems (ISWCS), Brussels, Belgium, August 2015.

[C47] Emil Björnson, Luca Sanguinetti, Marios Kountouris, “*Energy-Efficient Future Wireless Networks: A Marriage between Massive MIMO and Small Cells,*” Proceedings of IEEE Workshop on Signal Processing Advances in Wireless Communications (SPAWC), Stockholm, Sweden, July 2015.

[C46] Rami Mochaourab, Emil Björnson, Mats Bengtsson, “*Pilot Clustering in Asymmetric Massive MIMO Networks,*” Proceedings of IEEE Workshop on Signal Processing Advances in Wireless Communications (SPAWC), Stockholm, Sweden, July 2015.

[C45] Salil Kashyap, Emil Björnson, Erik G. Larsson, “*On the Feasibility of Wireless Energy Transfer Using Massive Antenna Arrays in Rician Channels,*” Proceedings of IEEE Workshop on Signal Processing Ad-

vances in Wireless Communications (SPAWC), Stockholm, Sweden, July 2015.

[C44] Emil Björnson, Luca Sanguinetti, Marios Kountouris, “*Designing Wireless Broadband Access for Energy Efficiency: Are Small Cells the Only Answer?*,” Proceedings of IEEE International Conference on Communication Workshop (ICCW), London, UK, June 2015.

[C43] Serveh Shalmashi, Emil Björnson, Marios Kountouris, Ki Won Sung, Mérouane Debbah, “*Energy Efficiency and Sum Rate when Massive MIMO meets Device-to-Device Communication*,” Proceedings of IEEE International Conference on Communication Workshop (ICCW), London, UK, June 2015.

[C42] Antonios Pitarokoilis, Emil Björnson, Erik G. Larsson, “*Optimal Detection in Training Assisted SIMO Systems with Phase Noise Impairments*,” Proceedings of IEEE International Conference on Communications (ICC), London, UK, June 2015.

[C41] Hei Victor Cheng, Daniel Persson, Emil Björnson, Erik G. Larsson, “*Massive MIMO at Night: On the Operation of Massive MIMO in Low Traffic Scenarios*,” Proceedings of IEEE International Conference on Communications (ICC), London, UK, June 2015.

[C40] Jingya Li, Emil Björnson, Tommy Svensson, Thomas Eriksson, Mérouane Debbah, “*Optimal Design of Energy-Efficient HetNets: Joint Precoding and Load Balancing*,” Proceedings of IEEE International Conference on Communications (ICC), London, UK, June 2015. **Best Student Paper Award.**

[C39] Mikko Vehkaperä, Taneli Riihonen, Maksym A. Girnyk, Emil Björnson, Mérouane Debbah, Lars K. Rasmussen, Risto Wichman, “*Asymptotic Analysis of Asymmetric MIMO Links: EVM Limits for Joint Decoding of PSK and QAM*,” Proceedings of IEEE International Conference on Communications (ICC), London, UK, June 2015.

[C38] Salil Kashyap, Emil Björnson, Erik G. Larsson, “*Can WPT Benefit from Large Transmitter Arrays?*,” Proceedings of IEEE Wireless Power Transfer Conference (WPTC), Boulder, Colorado, US, May 2015.

[C37] Luca Sanguinetti, Emil Björnson, Mérouane Debbah, Aris L. Moustakas, “*Optimal Linear Precoding in Multi-User MIMO Systems: A Large System Analysis*,” Proceedings of IEEE Global Communications Conference (GLOBECOM), Austin, Texas, USA, December 2014.

[C36] Emil Björnson, Erik G. Larsson, Mérouane Debbah, “*Optimizing Multi-Cell Massive MIMO for Spectral Efficiency: How Many Users Should Be Scheduled?*,” Proceedings of IEEE Global Conference on Signal and Information Processing (GlobalSIP), Atlanta, Georgia, December 2014.

[C35] Abba Kammoun, Axel Müller, Emil Björnson, Mérouane Debbah, “*Low-Complexity Linear Precoding for Multi-Cell Massive MIMO Systems*,” Proceedings of European Signal Processing Conference (EUSIPCO), Lisbon, Portugal, September 2014.

[C34] Xinlin Zhang, Michail Matthaiou, Mikael Coldrey, Emil Björnson, “*Energy Efficiency Optimization in Hardware-Constrained Large-Scale MIMO Systems*,” Proceedings of International Symposium on Wireless Communication Systems (ISWCS), Barcelona, Spain, August 2014.

[C33] Axel Müller, Abba Kammoun, Emil Björnson, Mérouane Debbah, “*Efficient Linear Precoding for Massive MIMO Systems using Truncated Polynomial Expansion*,” Proceedings of IEEE Sensor Array and Multichannel Signal Processing Workshop (SAM), A Coruña, Spain, June 2014. **Best Student Paper Award, Second Price.**

[C32] Xinlin Zhang, Michail Matthaiou, Emil Björnson, Mikael Coldrey, and Mérouane Debbah, “*On the MIMO Capacity with Residual Transceiver Hardware Impairments*,” Proceedings of IEEE International Conference on Communications (ICC), Sydney, Australia, June 2014.

[C31] Xinlin Zhang, Michail Matthaiou, Mikael Coldrey, Emil Björnson, “*Impact of Residual Transmit RF Impairments on Training-Based MIMO Systems*,” Proceedings of IEEE International Conference on Communications (ICC), Sydney, Australia, June 2014.

[C30] Emil Björnson, Michail Matthaiou, Mérouane Debbah, “*Circuit-Aware Design of Energy-Efficient Massive MIMO Systems*,” Proceedings of International Symposium on Communications, Control, and Signal

Processing (ISCCSP), Athens, Greece, May 2014.

[C29] Emil Björnson, Michail Matthaiou, Mérouane Debbah, “*Massive MIMO Systems with Hardware-Constrained Base Stations*,” Proceedings of IEEE Conference on Acoustics, Speech, and Signal Processing (ICASSP), Florence, Italy, May 2014.

[C28] Luca Sanguinetti, Aris Moustakas, Emil Björnson, Mérouane Debbah, “*Energy Consumption in multi-user MIMO systems: Impact of user mobility*,” Proceedings of IEEE Conference on Acoustics, Speech, and Signal Processing (ICASSP), Florence, Italy, May 2014.

[C27] Rasmus Brandt, Emil Björnson, Mats Bengtsson, “*Weighted Sum Rate Optimization for Multicell MIMO Systems with Hardware-Impaired Transceivers*,” Proceedings of IEEE Conference on Acoustics, Speech, and Signal Processing (ICASSP), Florence, Italy, May 2014.

[C26] Emil Björnson, Luca Sanguinetti, Jakob Hoydis, Mérouane Debbah, “*Designing Multi-User MIMO for Energy Efficiency: When is Massive MIMO the Answer?*,” Proceedings of IEEE Wireless Communications and Networking Conference (WCNC), Istanbul, Turkey, April 2014. **Best Paper Award.**

[C25] Serveh Shalmashi, Emil Björnson, Slimane Ben Slimane, Mérouane Debbah, “*Closed-Form Optimality Characterization of Network-Assisted Device-to-Device Communications*,” Proceedings of IEEE Wireless Communications and Networking Conference (WCNC), Istanbul, Turkey, April 2014.

[C24] Axel Müller, Emil Björnson, Romain Couillet, Mérouane Debbah, “*Analysis and Management of Heterogeneous User Mobility in Large-Scale Downlink Systems*,” Proceedings of Asilomar Conference on Signals, Systems, and Computers, Pacific Grove, California, USA, November 2013.

[C23] Nafiseh Shariati, Emil Björnson, Mats Bengtsson, Mérouane Debbah, “*Low-Complexity Channel Estimation in Large-Scale MIMO using Polynomial Expansion*,” Proceedings of IEEE Symposium on Personal, Indoor, Mobile and Radio Communications (PIMRC), London, UK, September 2013.

[C22] Emil Björnson, Jakob Hoydis, Marios Kountouris, and Mérouane Debbah, “*Hardware Impairments in Large-scale MISO Systems: Energy Efficiency, Estimation, and Capacity Limits*,” Proceedings of International Conference on Digital Signal Processing (DSP), Santorini, Greece, July 2013.

[C21] Emil Björnson, Agisilaos Papadogiannis, Michail Matthaiou, Mérouane Debbah, “*On the Impact of Transceiver Impairments on Relaying*,” Proceedings of IEEE Conference on Acoustics, Speech, and Signal Processing (ICASSP), pp. 4948-4952, Vancouver, Canada, May 2013.

[C20] John Flåm, Emil Björnson, Saikat Chatterjee, “*Pilot Design for MIMO Channel Estimation: An Alternative to the Kronecker Structure Assumption*” Proceedings of IEEE Conference on Acoustics, Speech, and Signal Processing (ICASSP), pp. 5061-5064, Vancouver, Canada, May 2013.

[C19] Emil Björnson, Marios Kountouris, Mérouane Debbah, “*Massive MIMO and Small Cells: Improving Energy Efficiency by Optimal Soft-Cell Coordination*,” Proceedings of International Conference on Telecommunications (ICT), Casablanca, Morocco, May 2013.

[C18] Emil Björnson, Per Zetterberg, Mats Bengtsson, “*Optimal Coordinated Beamforming in the Multicell Downlink with Transceiver Impairments*,” Proceedings of IEEE Global Communications Conference (GLOBECOM), Anaheim, California, USA, December 2012.

[C17] Emil Björnson, Mats Bengtsson, Gan Zheng, Björn Ottersten, “*Computational Framework for Optimal Robust Beamforming in Coordinated Multicell Systems*,” Proceedings of International Workshop on Computational Advances in Multi-Sensor Adaptive Processing (CAMSAP), San Juan, Puerto Rico, December 2011. **Best Student Paper Award.**

[C16] Emil Björnson, Mats Bengtsson, Björn Ottersten, “*Receive Combining vs. Multistream Multiplexing in Multiuser MIMO Systems*,” Proceedings of IEEE Swedish Communication Technologies Workshop (SweCTW), Stockholm, Sweden, October 2011.

[C15] Xueying Hou, Emil Björnson, Chenyang Yang, Mats Bengtsson, “*Cell-Grouping Based Distributed Beamforming and Scheduling for Multi-cell Cooperative Transmission*,” Proceedings of IEEE Symposium on Per-



sonal, Indoor, Mobile and Radio Communications (PIMRC), Toronto, Canada, September 2011.

[C14] Jinghong Yang, Emil Björnson, Mats Bengtsson, “*Receive Beamforming Design Based on a Multiple-state Interference Model*,” Proceedings of IEEE International Conference on Communications (ICC), Kyoto, Japan, June 2011.

[C13] Emil Björnson, Konstantinos Ntontin, Björn Ottersten, “*Channel Quantization Design in Multiuser MIMO Systems: Asymptotic versus Practical Conclusions*,” Proceedings of IEEE International Conference on Acoustics, Speech, and Signal Processing (ICASSP), Prague, Czech Republic, May 2011.

[C12] Emil Björnson, Mats Bengtsson, Björn Ottersten, “*Optimality Properties and Low-Complexity Solutions to Coordinated Multicell Transmission*,” Proceedings of IEEE Global Communications Conference (GLOBECOM), Miami, Florida, USA, December 2010.

[C11] Petri Komulainen, Antti Tölli, Bin Song, Florian Roemer, Emil Björnson, Mats Bengtsson, “*CSI Acquisition Concepts for Advanced Antenna Schemes in the WINNER+ Project*,” Future Network and Mobile-Summit 2010 Conference Proceedings, Florence, Italy, June 2010.

[C10] Emil Björnson, Randa Zakhour, David Gesbert, Björn Ottersten, “*Distributed Multicell and Multiantenna Precoding: Characterization and Performance Evaluation*,” Proceedings of IEEE Global Communications Conference (GLOBECOM), Honolulu, Hawaii, USA, December 2009.

[C9] Emil Björnson, Björn Ottersten, “*On the Principles of Multicell Precoding with Centralized and Distributed Cooperation*,” Proceedings of International Conference on Wireless Communications and Signal Processing (WCSP), Nanjing, China, November 2009. **Best Paper Award.**

[C8] Emil Björnson, Björn Ottersten, “*Training-Based Bayesian MIMO Channel and Channel Norm Estimation*,” Proceedings of IEEE International Conference on Acoustics, Speech, and Signal Processing (ICASSP), Taipei, Taiwan, April 2009.

[C7] Emil Björnson, Björn Ottersten, Eduard Jorswieck, “*On the Impact of Spatial Correlation and Precoder Design on the Performance of MIMO Systems with Space-Time Coding*,” Proceedings of IEEE International Conference on Acoustics, Speech, and Signal Processing (ICASSP), Taipei, Taiwan, April 2009.

[C6] Emil Björnson, Björn Ottersten, “*Post-User-Selection Quantization and Estimation of Correlated Frobenius and Spectral Channel Norms*,” Proceedings of IEEE International Symposium on Personal, Indoor and Mobile Radio Communications (PIMRC), Cannes, France, September 2008.

[C5] Emil Björnson, Pandu Devarakota, Samer Medawar, Eduard Jorswieck, “*Schur-convexity of the Symbol Error Rate in Correlated MIMO Systems with Precoding and Space-time Coding*,” Proceedings of Nordic Conference on Radio Science and Communications (RVK), Växjö, Sweden, June 2008.

[C4] Emil Björnson, Björn Ottersten, “*Pilot-based Bayesian Channel Norm Estimation in Rayleigh Fading Multi-antenna Systems*,” Proceedings of Nordic Conference on Radio Science and Communications (RVK), Växjö, Sweden, June 2008.

[C3] Emil Björnson, David Hammarwall, Randa Zakhour, Mats Bengtsson, David Gesbert, Björn Ottersten, “*Feedback design in multiuser MIMO systems using quantization splitting and hybrid instantaneous/statistical channel information*,” Proceedings of ICT Mobile and Wireless Communications Summit (ICT-Mobile-Summit), Stockholm, Sweden, June 2008.

[C2] Emil Björnson, Björn Ottersten, “*Exploiting Long-term Statistics in Spatially Correlated Multi-user MIMO Systems with Quantized Channel Norm Feedback*,” Proceedings of IEEE International Conference on Acoustics, Speech, and Signal Processing (ICASSP), Las Vegas, Nevada, USA, April 2008.

[C1] Emil Björnson, David Hammarwall, Björn Ottersten, “*Beamforming Utilizing Channel Norm Feedback in Multiuser MIMO Systems*,” Proceedings of IEEE Workshop on Signal Processing Advances in Wireless Communications (SPAWC), Helsinki, Finland, June 2007.

## Theses

[T2] Emil Björnson, “*Multiantenna Cellular Communications: Channel Estimation, Feedback, and Resource Allocation*,” Doctoral Thesis in Telecommunications, ACCESS Linnaeus Centre, Signal Processing Laboratory, KTH Royal Institute of Technology, November 2011. **Best PhD Award from EURASIP.**

[T1] Emil Björnson, “*Beamforming Utilizing Channel Norm Feedback in Multiuser MIMO Systems*,” Master of Science Thesis, Department of Electrosience, Lund University, January 2007.

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