

Report on

IEEE Technical Talk Series 2021



Expert: Dr. Emil Bjornson

April 16th 2021

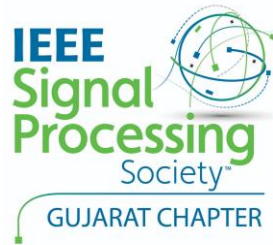
Title: MIMO Communication in 5G and Beyond

IEEE Signal Processing Society

Gujarat Section

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✚ Poster for the talk

The poster has a green and blue background with abstract wave-like patterns. At the top left, it says "IEEE Signal Processing Society Gujarat Chapter presents Expert Talk Series". At the top right is a smaller version of the IEEE logo. The main text reads: "Multiple-Input Multiple-Output (MIMO) technology plays a prominent role in Wi-Fi communications as well as 3G, 4G, and 5G networks". Below this is the title "MIMO Communication in 5G and Beyond". To the left is a portrait of Dr. Emil Bjornson. To the right, it says "April 16 2021 | 2 PM IST" and "Scan to Register" with a QR code. At the bottom, it says "(WebEx link will be sent to registered participants)".

IEEE Signal Processing Society Gujarat Chapter
presents
Expert Talk Series

Multiple-Input Multiple-Output (MIMO) technology plays a prominent role in Wi-Fi communications as well as 3G, 4G, and 5G networks

MIMO Communication in 5G and Beyond

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*Dr. Emil Bjornson
Professor,
KTH Royal Institute of
Technology, Sweden*

(WebEx link will be sent to registered participants)



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Expert Profile



Dr. Emil Bjornson **Professor, KTH Royal Institute of Technology, Sweden**

Expert Profile: Emil Björnson received the M.S. degree in engineering mathematics from Lund University, Sweden, in 2007, and the Ph.D. degree in telecommunications from the KTH Royal Institute of Technology, Sweden, in 2011. From 2012 to 2014, he held a joint post-doctoral position at the Alcatel-Lucent Chair on Flexible Radio, SUPELEC, France, and the KTH Royal Institute of Technology. He joined Linköping University, Sweden, in 2014, where he is currently an Associate Professor. In September 2020, he became a part time Visiting Full Professor at the KTH Royal Institute of Technology. He has authored the textbooks Optimal Resource Allocation in Coordinated Multi-Cell Systems (2013), Massive MIMO Networks: Spectral, Energy, and Hardware Efficiency (2017), and Foundations of User-Centric Cell-Free Massive MIMO (2021). He is dedicated to reproducible research and has made a large amount of simulation code publicly available. He performs research on MIMO communications, radio resource allocation, machine learning for communications, and energy efficiency. He has been on the Editorial Board of the IEEE Transactions on Communications since 2017. He has been a member of the Online Editorial Team of the IEEE Transactions on Wireless Communications since 2020. He has been an Area Editor in IEEE Signal Processing Magazine since 2021. He has performed MIMO research for over 14 years, his papers have received more than 12000 citations, and he has filed more than twenty patent applications. He is a host of the podcast Wireless Future and has a popular YouTube channel. He has received the 2014 Outstanding Young Researcher Award from IEEE ComSoc EMEA, the 2015 Ingvar Carlsson Award, the 2016 Best Ph.D. Award from EURASIP, the 2018 IEEE Marconi Prize Paper Award in Wireless Communications, the 2019 EURASIP Early Career Award, the 2019 IEEE Communications Society Fred W. Ellersick Prize, the 2019 IEEE Signal Processing Magazine Best Column Award,

the 2020 Pierre-Simon Laplace Early Career Technical Achievement Award, and the 2020 CTTC Early Achievement Award. He also coauthored papers that received Best Paper Awards at the conferences, including WCSP 2009, the IEEE CAMSAP 2011, the IEEE SAM 2014, the IEEE WCNC 2014, the IEEE ICC 2015, and WCSP 2017.

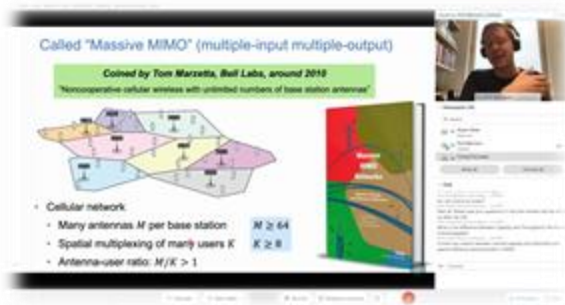
✚ Glimpses of the Talk



MIMO Communication in 5G and Beyond
Emil Björnson
Visiting professor, KTH Royal Institute of Technology, Sweden
Associate professor, Linköping University, Sweden
liu LINKÖPING UNIVERSITY



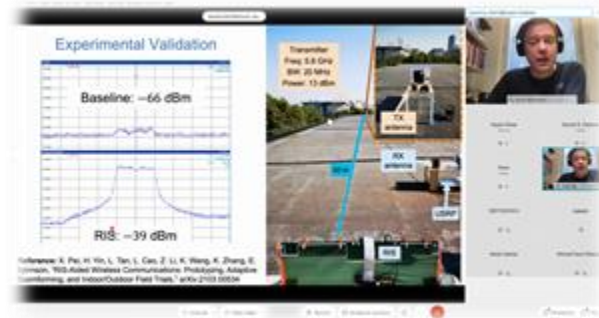
Traditional Ways to Improve Network Capacity



Called "Massive MIMO" (multiple-input multiple-output)
Coined by Tom Marzetta, Bell Labs, around 2010
"Noncooperative cellular wireless with unlimited numbers of base station antennas"
Cellular network
• Many antennas M per base station $M \geq 64$
• Spatial multiplexing of many users $K \geq 8$
• Antenna-user ratio: $M/K > 1$



Massive MIMO is a Reality: How "Massive" is it?
Erikson Live Broadcast, March 1, 2021
AIR 6419
64 antennas (192 elements)
20 kg
330 W over 200 MHz
Integrated circuitry



Experimental Validation
Baseline: -66 dBm
RIS: -39 dBm
Transmitter: Frang 5.0 GHz, BW: 20 MHz, Power: 13 dBm
References: X. Pei, H. Yin, L. Tan, Y. Cao, Z. Li, K. Wang, R. Zhang, B. L. Cao, "Wideband Wireless Communications Enabling Active Combining and Indoor/Outdoor Field Tests," arXiv:2103.05534



Cell-free Massive MIMO: Open Problems

- Scalability and Signal Processing Methods Basically Solved
 - E. Björnson, L. Sanguinetti, "Making Cell-Free Massive MIMO Competitive With MMSE Processing and Centralized Implementation," arXiv:1902.13611
 - E. Björnson, L. Sanguinetti, "A New Look at Cell-Free Massive MIMO: Making it Practical With Dynamic Cooperation," PIMRC 2019.
- Open problems
 - Resource allocation, broadcasting
 - Channel modeling
 - Prototype development

✚ Memento Format



✚ Number of Participants

Total: 222

IEEE Members: 105

NON-IEEE Members: 117

Report Prepared by: Prof. Arpan Desai