

Zhibo Pang

Tel: +46-730880004, E-mail: zhibo@kth.se

Homepage: <https://www.kth.se/profile/zhibo>

Linkedin: <https://www.linkedin.com/in/zhibopang>

Google Scholar: <https://scholar.google.com/citations?user=S14M7yMAAAAJ&hl=en>



Personal Information

Name: Zhibo Pang **Gender:** Male **Position:** Adjunct Professor/Senior Principal Scientist

Affiliation: KTH Royal Institute of Technology/ABB Corporate Research Sweden

Research Interests

1. Perception, control, and safe interaction of intelligent robots
2. Intelligent robot and automation systems
3. Networked and virtualized industrial control infrastructure

Biography

Academic Biography

Dr. Zhibo Pang, PhD&MBA, received B.Eng. in Electronic Engineering from Zhejiang University, Hangzhou, China in 2002, MBA in Innovation and Growth from University of Turku, Turku, Finland in 2012, and PhD in Electronic and Computer Systems from the KTH Royal Institute of Technology, Stockholm, Sweden in 2013. He is currently a Senior Principal Scientist on Industrial Communication at ABB Corporate Research, Västerås, Sweden and Adjunct Professor at KTH Royal Institute of Technology, Stockholm, Sweden. He was Adjunct Professor at University of Sydney from 2019 to 2023 and Adjunct Professor at Zhejiang University from 2019 to 2022. Before joining ABB, he was co-founder and CTO of startup companies such as Ambigua Medito AB.

Zhibo Pang is a Senior Member of IEEE, Steering Committee member of the IEEE IoT Technical Community, Administration Committee member of IEEE Industrial Electronics Society (IES), Member of IEEE IES Industry Activities Committee, Chair of IEEE Technical Committee on Cloud and Wireless Systems for Industrial Applications, and Co-Chair of IEEE TC on Industrial Informatics. He is Associate Editor of IEEE Transactions on Industrial Informatics, IEEE Journal of Biomedical and Health Informatics, IEEE Transactions on Consumer Electronics, IEEE Journal of Emerging and Selected Topics in Industrial Electronics, and IEEE Internet of Things Magazine. He has served as General Co-Chair of IEEE INDIN2025, General Chair of IEEE ES2017, General Co-Chair of IEEE WFCS2021, and Invited Speaker at Gordon Research Conference AH2018. He has delivered 45+ keynotes or invited talks at international conferences such as IEEE IECON, ICC, IoT World Forum, INDIN, ISIE, ICIT, ETFA, ICPS, WFCS, GLOBECOM, WCNC, 6G Summit, VTC, 5G World Forum, etc.

He was awarded the Inventor of the Year Award by ABB Corporate Research Sweden, three times in 2016, 2018, and 2021 respectively. He won the Runner-up Award in the ABB Process Automation Global HackSummit 2022, the Outstanding Paper Awards in ICACT2013, the First Place Prize of RFID Nordic EXPO in 2008, and the National Great Invention Award of China in 2005. His students won the Best Student Paper Finalist Award in ICIRA2023, the IES Young Professionals & Students Paper Assistance award in IEEE ISIE2024 and IEEE IECON2022, the Automation Student 2022 award of Swedish Automation.

He works in robotics, artificial intelligence, control, computing, communication, and electronics for Industry 4.0 and Healthcare 4.0. His work has been funded by European Union, Swedish Strategic Foundation (SSF), Swedish Innovation Agency (Vinnova), and ABB Group, with a total amount over 900MEUR. He has 23 granted patents in USA, Europe, and Japan, 120+ journal papers, 60+ conference papers, and 9000+ citations. His research outcomes have been commercialized in many industrial leading products such as the ABB Ability Condition Monitoring for industrial powertrains, ABB Mobile YuMi collaborative robot, ABB WirelessHART for process automation, ABB free@home and Welcome IP for building automation, and Hitachi Energy TropOS Mesh for power grids, which have achieved millions of installations globally with over 100 million EUR revenue.

Since 2020, he has been selected in the Stanford University's World's Top 2% Scientists - Annual Scientific Influence Ranking every year, ranked as top 1% among the listed scientists in multiple sub-fields, including top 0.3% in Electrical and Electronics Engineering, top 0.7% in Artificial Intelligence and Image Processing, and top 0.7% in Networking and Telecommunications.

Self-description

I am a passionate innovator and research leader in digital transformation of industry with 20+ years of experiences at universities, large company, and start-ups. Spanning the entire innovation cycle, I have been playing the roles of visionary leader, concept creator, resource investigator, cross-organizational coordinator, technical mentor, hardcore coder, product manager, and customer communicator. I work on enabling technologies in robotics, artificial intelligence, control, computing, communication, and electronics for Industry 4.0 and Healthcare 4.0.

Keywords

Embodied Intelligence, AI/LLM/LFM/Machine Learning, Robotics, Cloud-Fog Automation, Cyber Physical Systems, Cybersecurity, Functional Safety, Industry4.0, Healthcare4.0, Internet-of-Things, WirelessHP, Cloud/Edge Computing, Control System, Wireless communication, System-on-Chip, FPGA/ASIC, Process automation, Power grids, Biomedical Informatics

Key Facts

23 granted patents in USA/EU/JP, 120+ journal papers, 60+ conference papers, 45+ invited talks, 2 edited proceedings, Google Scholar citation 9000+, h-index 46

Industrial Experience

Senior Principal Scientist (2019.10-present), Principal Scientist (2017.8-2019.9), Senior Scientist (2016.1-2017.7), Scientist (2013.07-2015.12), Associate Scientist (2011.8-2013.07), ABB Corporate Research, Vasteras, Sweden

Start-up Entrepreneur/Co-founder, Shanghai Shengyue Electronics Tech Co. Ltd. (China, 2007.7-2008.7), and Ambigua Medito AB (Sweden, 2008.8-2009.9)

Department Manager (2004-2007.07), Project Leader and Product Manager (2003-2004), Chip Design Engineer (2002.07-2003), Nationalchip Sci&Tech Co. Ltd., Hangzhou, China

Education

PhD (Electronic and Computer Systems), KTH Royal Institute of Technology, Stockholm, Sweden, 2010.05-2013.7

MBA for PhD (Innovation and Growth), University of Turku, Turku, Finland, 2009.10-2012.10

EU-China Managers Exchange and Training Program (METP), studied business administration courses at the business schools of China-Europe International Business School (Shanghai, China), Manchester Metropolitan University (Manchester, UK), ESCP Europe Paris (Paris, France), and Solvay Brussels School of Economics and Management of the Université Libre de Bruxelles (Brussels, Belgium), 2010.5 -2010.10,

B.Eng (Electronic Engineering), Zhejiang University, Hangzhou, China, 1998.9-2002.6

Academic Duties

Appointments at Universities

[U13] **Adjunct Professor** (on Industrial Wireless Communication), Department of Intelligent Systems, KTH Royal Institute of Technology, Stockholm, Sweden, 2021.1-present

[U12] **Industrial Supervisor of PhD Student**, University of Navarra, Spain 2023.10-present

[U10] **Industrial Supervisor of PhD Student**, University of Glasgow, Glasgow, UK, 2020.12-2024.4

[U09] **Adjunct Professor** (on Industrial IoT), School of Electrical and Information Engineering, University of Sydney, Sydney, Australia, 2019.2-2023.1

[U08] **Adjunct Professor**, School of Mechanical Engineering, Zhejiang University, Hangzhou, China, 2019.4-2022.3

[U07] Affiliated Faculty, KTH Royal Institute of Technology, Stockholm, Sweden, 2018.01-2021.10

[U06] Industrial Supervisor of PhD Student, Linköping University, Linköping, Sweden, 2019.4-2021.6

[U05] Industrial Supervisor of PhD Student, Department of Physics, Stockholm University, Stockholm, Sweden, 2019.11-2020.06

[U04] International Advisor, Department of Industrial Engineering, Tsinghua University, Beijing, China, 2013-2018

[U03] Industrial Supervisor of PhD Students, Electric Engineering School, KTH Royal Institute of Technology,

Stockholm, Sweden, 2015-2016

[U02] Adjunct Professor, Beijing University of Posts and Telecommunications (BUPT), Beijing, China. 2014-2018

[U01] PhD researcher, KTH Royal Institute of Technology, Stockholm, Sweden, 2007.12-2013.07

Appointments in Academic Community

[A10] **AdCom Member** (non-voting), IEEE Industrial Electronics Society, 2023-present

[A09] **Standing Committee Member**, IEEE IES Industry Activities Committee, 2020-present

[A08] **Steering Committee Member**, IEEE Internet of Things Technical Community (IoT-TC), 2023-2025

[A07] **TC Vice-Chair**, IEEE IES Technical Committee on Cloud and Wireless Systems for Industrial Applications, 2023-present

[A06] **TC Co-Chair**, IEEE IES Technical Committee on Industrial Informatics, 2017-present.

[A05] **TC Industry Liaison**, IEEE IES Technical Committee on Factory Automation, 2023-present.

[A04] **Founding Member**, Industrial Wireless Technical Working Group (IWSTWG), National Institute of Standards and Technology (NIST), U.S. Department of Commerce, 2017-present

[A03] Award Committee Member, IEEE Technical Committee on Cyber-Physical Systems, 2020-2020

[A02] Chair of Sub-TC, Sub-TC on Industrial Internet of Things Services and People, IEEE IES Technical Committee on Industrial Informatics, 2015-2020,

[A01] Vice-Chair of Sub-TC, Sub-TC on Internet of Things Optimization, IEEE IES Technical Committee on Cloud and Wireless Systems for Industrial Applications, 2015-2016,

Editorial Service

[AE06] **Associate Editor**, IEEE Transactions on Sustainable Computing, 2024-present

[AE05] **Associate Editor**, IEEE Transactions on Consumer Electronics, 2024-present

[AE04] **Associate Editor**, IEEE Internet of Things Magazine (IoTM), 2024-present.

[AE03] **Associate Editor**, IEEE Journal of Emerging and Selected Topics in Industrial Electronics (JESTIE), 2019-present.

[AE02] **Associate Editor**, IEEE Journal of Biomedical and Health Informatics (JBHI), 2017-present.

[AE01] **Associate Editor**, IEEE Transactions on Industrial Informatics (TII), 2016-present.

[GE14] Guest Editor, IEEE Journal on Selected Areas in Communications, SS on “Co-Design of Communication, Computing, and Control in Industrial Cyber-Physical Systems”, 2024-2025

[GE13] Guest Editor, IEEE Network, SS on “Cyber-Physical Security for Cloud and Fog-Hosted Industrial Cyber-Physical System”, 2024-2025

[GE12] Guest Editor, IEEE Journal of Selected Areas in Sensors (JSAS), SS on “Intelligent IoT for Sustainable Agriculture and Food Industries”, 2024-2025

[GE11] Guest Editor, IEEE Internet of Things Journal, SS on “Artificial Intelligence Integrated with Smart Sensing: Techniques, Systems, and Applications”, 2024-2025

[GE10] Guest Editor, IEEE Transaction on Consumer Electronics, SS on “Emerging signal processing techniques and protocols for interconnected consumer electronics in critical applications”, 2023-2024

[GE09] Guest Editor, IEEE Transaction on Consumer Electronics, SS on “Emerging technologies and applications of consumer electronics for healthy and sustainable life”, 2023-2024

[GE08] Guest Editor, IEEE Journal of Emerging and Selected Topics in Industrial Electronics, SS on “Artificial Intelligence and Low-code Technology for Customized Manufacturing Systems”, 2023-2024

[GE07] Guest Editor, IEEE Transactions on Consumer Electronics, SS on “Emerging Technologies and Applications of Consumer Electronics for Healthy and Sustainable Life”, 2023-2024

[GE06] Guest Editor, Proceedings of the IEEE, SI on “Real-Time Networks and Protocols for Factory Automation and Process Control Systems”, 2018-2019,

[GE05] Guest Editor, IEEE Reviews in Biomedical Engineering (RBME), 2017-2018,

[GE04] Guest Editor, IEEE Internet of Things Journal, SI on “Low-latency High-reliability Communications for IoT”, 2018-2019,

[GE03] Guest Editor, IEEE Transactions on Industrial Informatics, SS on “Developments in Artificial Intelligence for Industrial Informatics”, 2017-2018,

[GE02] Guest Editor, IEEE Access, SI on “Key Technologies for Smart Factory of Industry 4.0”, 2017-2018,

[GE01] Guest Editor, Wireless Communications and Mobile Computing (Wiley and Hindawi), SI on “Time-Critical Wireless Networks for Industrial Systems and Mobile Robotics”, 2017-2018:

[EB04] Editorial Board, Urban Lifeline (Springer), 2023-present,

[EB03] Editorial Board, Journal of Management Analytics (Taylor & Francis), 2015-2018,

[EB02] Editorial Board, Journal of Industrial Information Integration (Elsevier), 2015-2018,

[EB01] Editorial Board, International Journal of Modeling, Simulation, and Scientific Computing (WorldScientific), 2017-2018,

Standardization Service

[ST06] Vice Chair, Working Group for IEEE Std 3178: IEEE Standard for General Requirements and Protocols for Software-Defined Physical Layer of Wireless Backscatter Networks, 2022-present

[ST05] Member, Working Group for IEEE P2805.1: Self-Management Protocols for Edge Computing Node, 2020-present

[ST04] Member, Working Group for IEEE P2805.2: Data acquisition, Filtering and buffering Protocols for Edge Computing Node, 2020-present

[ST03] Member, Working Group for IEEE P2805.3: Cloud-Edge Collaboration Protocols for Machine Learning, 2020-present

[ST02] Member, Working Group for IEEE P2805.4: Edge Collaboration Protocols for Federated Learning, 2023-present

[ST01] **Founding Member**, Working Group for IEEE P3388 (former P1451.5p): Standard for Radio Frequency Channel Specifications for Performance Assessment of Industrial Wireless Systems, 2021-present

Public Funding Assessment

1. [Proposal Reviewer], a proposal on robot skin (details undisclosed), European Research Council (ERC) <http://erc.europa.eu>, 2021
2. [Proposal Reviewer], a proposal on high performance wireless communication (details undisclosed) aiming for NWA-ORC grant, Dutch Research Council (NWO) www.nwo.nl, The Netherlands, Feb 2020
3. [Proposal Reviewer], a proposal on industrial wired and wireless networks (details undisclosed) aiming for the National Fund for Scientific and Technological Development (FONDECYT), National Commission for Scientific and Technological Research of Chile (CONICYT-Chile) <https://www.conicyt.cl/>, Chile, Sep 10, 2019
4. [Proposal Reviewer] a proposal on low latency wireless (details undisclosed) aiming for funding from The Centre for Industrial Information Technology (CENIIT) at Linköping University <https://liu.se/en>, Sweden, Sep 2017

Appointments in Major Projects

1. Advisory Board Member, 6G-SHINE (6gshine.eu), a project in the Smart Networks and Services Joint Undertaking (SNS JU) under the European Union's Horizon Europe, 2023-2025

PhD/Licentiate Assessment Committee

1. Rijad Alisic, PhD thesis entitled “Defense of Cyber-Physical Systems Against Learning-based Attackers”, KTH Royal Institute of Technology, Sweden, Nov 10, 2023
2. Pedro Maia de Sant Ana, PhD thesis entitled "Age-Based Metrics for Joint Control and Communication in Cyber-Physical Industrial Systems", Aalborg University, Denmark, Aug 29, 2023
3. Daniel Bujosa Mateu, Licentiate thesis entitled "Enabling adoption of TSN by the Industry", at Mälardalen University (MDU), Sweden, Apr 20, 2023
4. Thomas Jacobsen, PhD thesis entitled “Radio Resource Management for Uplink Ultra-Reliable Low-Latency Communications”, Aalborg University, Supervisor: Professor Preben Mogensen, Aug 23, 2019

5. Weilin Zang, PhD thesis entitled “Research on Energy-Efficient Communication Scheme for Dynamic Characteristics of Wireless Body Area Network”, University of Chinese Academy of Sciences, Supervisor: Professor Ye Li, 2018
6. Xiaofan Mao, PhD thesis entitled “Research on Intelligent Detection Methods for Arrhythmia and High-performance Implementation”, University of Chinese Academy of Sciences, Supervisor: Professor Ye Li, 2018

Conference Service – Organization

Zhibo Pang has contributed 40 times in organizing overall conferences, technical tracks, workshops, forums, tutorials, or sessions at international conferences, including the following IEEE conferences: ETFA2024 Italy, ICIT 2024 UK, IES ONCON2023 virtual, IECON2023 Singapore, IESES2023 China, ISIE2023 Finland, ICPS2023 China, ICIT2023 USA, INDIN2023 Germany, WFCS2023 Italy, IECON2022 Belgium, BHI2022 Greece, ICIT2022 China, ICPS2022 UK, WFCS2022 Italy, ISIE2021 Japan, INDIN2021 Spain, ICC2021 Canada, BHI2021 Greece, Globecom2020 Taiwan, INDIN2020 China, ETFA2019 Spain, ICPS2019 Taiwan, INDIN2019 Finland, ICII2019 USA, BHI2018 USA, INDIN2016 France, ISIE2016 USA, ICIT2016 Taiwan, ICES2014), Aug 2014, Shanghai, China.

[CO42] [Industry Forum Chairs] 29th IEEE International Conference on Emerging Technologies and Factory Automation (ETF2024), 10th-13th September 2024, Padova, Italy

[CO41] [**General Chair**] 23rd IEEE International Conference on Industrial Informatics INDIN2025, Kunming, China, July 12-15, 2025

[CO40] [Track Co-Chair] 2024 EuCNC & 6G Summit, Antwerp, Belgium, Jun 3-6, 2024

[CO39] [Industry Co-Chair] IEEE International Conference on Industrial Technologies (ICIT 2024), Bristol, UK, Mar 25-27, 2024

[CO38] [Industry Co-Chair] 2nd IEEE Industrial Electronics Society Annual Online Conference (IES ONCON2023), Dec 8-11, 2023, virtual

[CO37] [Exhibition and Industry Co-Chair] 49th Annual Conference of the IEEE Industrial Electronics Society (IECON2023), October 16-19, 2023, Singapore

[CO36] [Program Committee] The 32nd ACM International Conference on Information and Knowledge Management (CIKM'23) hosted workshop: The 5th International Workshop on Internet of Things of Big Data for Healthcare (IoTBDH-2023), Brimingham, UK, October 21-25, 2023

[CO35] [Industry Co-Chair] 3rd IEEE International Conference on Industrial Electronics for Sustainable Energy Systems (IESES2023), Shanghai, China, July 26-28, 2023.

[CO34] [Track Co-Chair] 32nd IEEE International Symposium on Industrial Electronics (ISIE2023), Helsinki-Espoo, Finland, June 19-21, 2023

[CO33] [Industry Co-Chair] IEEE International Conference on Industrial Cyber Physical Systems (ICPS2023), May 8-11, 2023, Wuhan, China

[CO32] [Track Co-Chair and Industry Co-Chair] IEEE International Conference on Industrial Technologies (ICIT 2023), Orlando, Florida, USA, Apr. 4-6, 2023

[CO31] [Technical Track Co-Chair] IEEE International Conference on Industrial Informatics (INDIN2023), 17th - 20th July 2023, Lemgo, Germany

[CO30] [Industry Co-Chair] 19th IEEE International Conference on Factory Communication Systems (WFCS 2023), April 26 - 28, 2023, Pavia, Italy

[CO29] [Organizer of Special Session] the 48th Annual Conference of the IEEE Industrial Electronics Society (IECON2022), October 18-21, 2022, Brussels, Belgium

[CO28] [Workshop Organizer] Workshop on Healthcare 4.0, the 48th Annual Conference of the IEEE Industrial Electronics Society (IECON2022), October 18-21, 2022, Brussels, Belgium

[CO27] [Workshop Organizer] Workshop on Industrial Wireless Technologies and Systems, the 48th Annual Conference of the IEEE Industrial Electronics Society (IECON2022), October 18-21, 2022, Brussels, Belgium

[CO26] [Associate Editor] 2022 IEEE-EMBS International Conference on Biomedical and Health Informatics (BHI), Sep. 27 - 30, 2022, Ioannina, Greece

[CO25] [Industry Forum Co-Chair, Track Chair] 2022 IEEE International Conference on Industrial Technology (ICIT2022), online and Shanghai, China, 22-25 Aug 2022

- [CO0] [Industry Forum Co-Chair] The 5th IEEE International Conference on Industrial Cyber-Physical Systems (ICPS2022), 24 – 26 May 2022, online and Coventry, United Kingdom.
- [CO24] [Industry Co-Chair] 18th IEEE International Conference on Factory Communication Systems (WFCS 2022), April 27 - 29, 2022, online and Pavia, Italy
- [CO23] [Industry Forum Co-Chair] The IEEE 30th International Symposium on Industrial Electronics (ISIE2021), held 20-23 June 2021, online and Kyoto, Japan.
- [CO22] [Tutorial Co-Chair] 19th IEEE International Conference on Industrial Informatics (INDIN2021), 21-23 July 2021, Palma de Mallorca, Spain
- [CO21] [Steering Committee] EAI ICMTel 2022 - 4th EAI International Conference on Multimedia Technology and Enhanced Learning, April 15-16, 2022, Leicester, Great Britain
- [CO20] [Steering Committee] EAI ICMTel 2021 -3rd EAI International Conference on Multimedia Technology and Enhanced Learning, April 8-9, 2021, Leicester, UK (Online)
- [CO19] [Workshop Organizer] Workshop on Extreme URLLC towards 6G Connectivity, The IEEE International Conference on Communications (ICC 2021), 14-23 June 2021, Virtual / Montreal, Canada
- [CO18] [Industrial Liaison Co-Chair] IEEE-EMBS International Conference on Biomedical and Health Informatics (BHI'21) Jointly Organized with the IEEE-EMBS International Conference on Wearable and Implantable Body Sensor Networks (BSN'21), Athens, Greece, from 21-24 September, 2021
- [CO17] [**General Co-Chair**] 17th IEEE International Conference on Factory Communication Systems (WFCS2021), 9 - 11 June 2021, Linz, Austria
- [CO16] [Workshop Organizer] Workshop on Information Freshness, Communications, Control, and Computing for Industrial IoT, IEEE Global Communications Conference (GlobeCom2020), 8–10 December 2020, Taipei, Taiwan
- [CO15] [Organizer of 2 Special Sessions] the 46th Annual Conference of the IEEE Industrial Electronics Society (IECON2020), Singapore, Oct 18-20, 2020
- [CO14] [Tutorial Co-Chair, Organizer of Special Session] 2020 IEEE 18th International Conference on Industrial Informatics (INDIN2020), Guangzhou, China, 11-13 July 2020
- [CO13] [Organizer of Invited Session] The 1st International Conference on Industrial Artificial Intelligence (IAI2019), July 23-25, 2019 Shenyang, Liaoning, China
- [CO12] [Organizer of Special Session] The 24th IEEE Conference on Emerging Technologies and Factory Automation (ETFA2019), Zaragoza, Spain, September 10th - 13th, 2019
- [CO11] [Organizer of 4 Special Sessions] The 2nd IEEE International Conference on Industrial Cyber-Physical Systems (ICPS2019), Taipei, Taiwan, May 6-9, 2019
- [CO10] [Industrial Forum Co-Chair, and Organizer of Special Session] The IEEE International Conference on Industrial Informatics (INDIN2019), Helsinki, Finland, July 23-25, 2019
- [CO09] [Panel Co-Chair] The 2nd IEEE International Conference on Industrial Internet (ICII2019), Orlando, USA, Nov 11-12, 2019
- [CO08] [Associate Editor] The IEEE Conference on Biomedical and Health Informatics (BHI) 2018, Las Vegas, Nevada, USA, 4-7 March 2018.
- [CO07] [**General Co-Chair**] The 5th IEEE International Conference on Enterprise Systems (ES2017), Beijing, China, Sep 22-24, 2017
- [CO06] [**General Chair**] The International Academician Forum on Industry 4.0 and Made-in-China 2025, Yiwu, China, Sep 18-20, 2017
- [CO05] [Industrial Liaison] 17th international Conference on Computer Analysis of Images and Patterns (CAIP2017), 22-24 Aug, 2017, Ystad, Sweden
- [CO04] [**General Chair**] Karolinska Workshop on the Convergence of Sciences, Engineering, Medicine, and Management for Aging Health, May 22, 2017, Stockholm, Sweden
- [CO03] [Organizer of Tutorial] the 14th IEEE International Conference on Industrial Informatics (INDIN2016), 18-21 July 2016, Futuroscope-Poitiers, France
- [CO02] [Organizer of Special Session] 2016 25th IEEE International Symposium on Industrial Electronics (ISIE2016), Jun8-10, 2016, Santa Clara, USA

[CO01] [Organizer of Special Session] 2016 117th IEEE International Conference on Industrial Technology (ICIT2016), Mar14-17, 2016, Taipei, Taiwan

Conference Service – TPC Member

[TPC18] The 1st IEEE Industrial Electronics Society Annual On-Line Conference (ONCON-2022), virtual, December 9-11, 2022.

[TPC17] IEEE Global Communications Conference (GLOBECOM2019) workshop on Future wireless access for Industrial IoT (FutureIIoT), 9-13 December 2019, Waikoloa, HI, USA

[TPC16] The 11th International Symposium on UbiSafe Computing (UbiSafe 2019), Atlanta, USA, July 14-17, 2019

[TPC15] The 19th IEEE International Conference on Scalable Computing and Communications (ScalCom-2019), Leicester, UK, 19-23 August 2019.

[TPC14] The 15th International Symposium on Pervasive Systems, Algorithms and Networks (I-SPAN 2018), Yichang, China, October 16-18, 2018

[TPC13] The 16th IEEE International Conference on Smart City, (Smart City 2018), Exeter, UK, Jun 28-30, 2018

[TPC12] The 2018 IEEE International Conference on Cyber, Physical and Social Computing (CPSCom 2018), Halifax, Canada, July 30 – Aug 3, 2018

[TPC11] The 6th International Conference on Enterprise Systems (ES2018), Limassol, Cyprus, Oct 01-02, 2018

[TPC10] IEEE International Congress on Big Data, July 2-7, 2018, San Francisco, CA, USA

[TPC09] The 3rd EAI International Conference on Smart Grid and Innovative Frontiers in Telecommunications, APRIL 23–25, 2018, AUCKLAND, NEW ZEALAND

[TPC08] The 1st IEEE International Conference on Industrial Cyber-Physical Systems (ICPS 2018), Saint Petersburg, Russia, on May 15-18, 2018.

[TPC07] The 3rd International Conference on Internet of Things, Big Data, and Security (IoTBDS2018), 19-21 March, 2018, Funchal, Madeira, Portugal

[TPC06] The 3rd International Conference on Cybernetics (CYBCONF2017), Exeter, UK, 21-23Jun, 2017

[TPC05] The 2nd International Conference on Enterprise Architecture and Information Systems (E AIS 2017), July 9-13, 2017, Hamamatsu, Japan

[TPC04] International Conference on Smart Grid Inspired Future Technologies (SmartGIFT2016), May 9–20, 2016, Liverpool, Great Britain

[TPC03] International Conference on Internet of Things and Big Data (IoTBD2016), Apr23-25, 2016, Rome, Italy

[TPC02] IEEE Smart City 2015 Conference, Dec19-21, 2015, Chengdu, China

[TPC01] The 13th IEEE International Conference on Ubiquitous Computing and Communications (IUCC2014), Dec 2014, Chengdu, China

Teaching Statement

Summary:

Zhibo Pang has developed and been delivering new courses for graduate students at KTH with good feedback from students. He has rich experiences in supervising master, PhD, and postdoc students with high standard requirements of innovation. He trains the students with comprehensive capabilities for high quality innovation, including not only theoretical skills but also practical skills. The students typically deliver their results through not only publications but also workable prototypes and even patents. He also guides the students to establish their own research visions by sharing with them the mega trends in industries, the cutting-edge industrial challenges, and the gaps of the state-of-the-art from academia and industry. He has (co-)supervised 5 postdocs, 13 PhDs, and 40 masters. These students were born in more than 10 countries and about 1/3 of them are female.

Courses:

[C01] KTH, master course, EQ2461 Seminars in Information and Network Engineering, regular guest lecturer

[C01] KTH, PhD course, FEO3290 Selected Topics on Emerging Information Technologies for Industrial Digitalization, develop and deliver half of the lectures

[C01] KTH, Master and PhD course, EQ2855 Emerging Information Technologies for Industrial Digitalization, develop and deliver half of the lectures

(Co-)Supervised Postdoc:

[PO005] Deyou Zhang, on “High accuracy positioning, security and machine learning for intelligent wireless communications”, Royal Institute of Technology (KTH), 2020.01-2023.12.

[PO004] Yifan Gu, on “Low latency and high reliability wireless communication for industrial applications”, University of Sydney, Australia, 2019.02-2021.06, currently Assistant Professor at Shenzhen University, China

[PO003] Jing Yue (female), on “Distributed Fog Computing Based on Batched Sparse Codes for Industrial Control”, Royal Institute of Technology (KTH), Sweden, 2017.03-2019.02, currently Experience Researcher at Ericsson Research, Sweden

[PO002] He Chen, on “Low latency and high reliability wireless communication for industrial applications”, University of Sydney, Australia, 2018.01-2019.05, currently Assistant Professor at the Chinese University of Hong Kong, China.

[PO001] Ming Zhan, on “Channel coding in high reliability and low latency wireless communication for industrial applications”, University of Electronics Science and Technology of China, China, and Royal Institute of Technology (KTH), Sweden, 2016.09-2017.08, currently Professor at the Southwest University, Chongqing, China.

(Co-)Supervised PhD students:

[PhD15] Yichen Luo, on “Deterministic cloud and fog computing for industrial cyber physical systems and embodied intelligence”, Royal Institute of Technology (KTH), Sweden, 2024.9-2028.9 (expected)

[PhD14] Yijia Liu, on “Cloud Fog Automation-based Open Wireless Communication for Industrial Cyber Physical Systems”, Industrial Cyber Physical Systems, Spain, and Royal Institute of Technology (KTH), Sweden, 2023.10-2027.9

[PhD13] Le Zhang (female), on “Large Language Model for Time Series Prediction in Industrial Cyber Physical Systems”, Xi’an Jiaotong University, China, and Royal Institute of Technology (KTH), Sweden, 2023.11-2024.10

[PhD12] Peizhou Du, on “Computational acceleration of complex motion control driven by digital twin”, Zhejiang University, China, 2023.6-2024.2

[PhD11] Jialin Zhang (female), on “Time Critical Control over Virtualized Computing and Wireless Networks for Cloud Fog Automation”, Chinese Academy of Science, China, and Royal Institute of Technology (KTH), Sweden, 2022.10-2023.5

[PhD10] Honghao Lyu, on “Robot control over wireless networks and edge computing”, Zhejiang University, China, and Royal Institute of Technology (KTH), Sweden, 2021.12-2022.10. He won the IES Young Professionals & Students Paper Assistance at the 48th Annual Conference of the IEEE Industrial Electronics Society (IECON2022), Oct 18-22, 2022, Brussels, Belgium

[PhD09] Fei Pan (female), on “Physical layer security in wireless communication for industrial applications”, University of Electronics Science and Technology of China, China, and Royal Institute of Technology (KTH), Sweden, 2017.11-2018.10, currently Associate Professor at the Sichuan Agricultural University, Ya’an, China.

[PhD08] Deep Shrestha, on “Precise clock synchronization in wireless communication for industrial applications”, Centre Tecnològic de Telecomunicacions de Catalunya, Spain, 2017.01-2017.05, currently Research Scientist at Ericsson, Barcelona, Spain.

[PhD07] Michele Luvisotto, on “Customized physical layer in high performance wireless communication for industrial applications”, 2016-2017, University of Padova, Italy, 2016.03-2016.09, currently Research Group Manager at Hitachi-ABB Power Grids Research, Vasteras, Sweden.

[PhD06] Jing Yue (female), on “Network coding in high performance wireless communication for industrial applications”, University of Sydney, Australia, 2016.12-2017.02, then she continued her career as Postdoc research at Royal Institute of Technology (KTH), Sweden.

[PhD05] Xiaolin Jiang (female), on “Wireless Communication for Critical Control: Analysis and Experimental Validation”, Royal Institute of Technology (KTH), Sweden, 2015.09-2020.05, she spent 50% of time at ABB under my daily supervision, passed PhD defense on 2020-05-29, currently Experience Researcher at Ericsson Research, Sweden.

[PhD04] Abdul Jabbar, on “Agile intelligent beamforming antenna for industrial control”, University of

Glasgow, UK, 2020.11-2024.04

[PhD03] Yu Liu, on “Enable the landing of Internet of Things: a holistic approach”, Linköping University, Sweden, 2019.04-2021.06, currently Experience Researcher at Ericsson Research, Sweden

[PhD02] Emil Hakansson, on “Quantum communication for critical industrial applications”, Stockholm University, Sweden, 2019.09-2020.03, my responsibility was handed over to another colleague then another company due to ABB’s divestment of Power Grids business.

[PhD01] Xiaolin Jiang (female), on “Wireless Communication for Critical Control: Analysis and Experimental Validation”, Royal Institute of Technology (KTH), Sweden, 2015.09-2020.05, she spent 50% of time at ABB under my daily supervision, passed PhD defense on 2020-05-29, currently Experience Researcher at Ericsson Research, Sweden.

Supervised Master Students:

[M040] Liyuan Chen, KTH Royal Institute of Technology, “Time Critical Communication over Open Wireless Networks”, 2024.01-2024.10,

[M039] Jan Henke, Technical University of Munich, “Digital Twin-Driven Efficient Data Collection for Industrial Powertrain”, 2024.04-2024.10,

[M038] Yanghang Zeng, Aalto University, Finland, “Efficient Data Collection and Communication of Industrial Internet of Things Solutions”, 2023.05-2023.11, currently with ABB Research Sweden

[M037] Zexun Cao, University of Trento, Italy, “Cloud-Fog Automation Based Time-Critical Control: Modeling, Optimization and Task Allocation”, 2023.03-2023.10

[M036] Jing Yan (female), University of Trento, Italy, and Aalto University, Finland, ““Experimental Study and Performance Analysis of Cloud Computing Architectures for Industrial Control Systems”, 2022.02-2022.07, currently with Intel, Finland

[M035] Anna Bengtsson (female), Uppsala University, Sweden, “Latency Aware and Event-Based Wireless Control for Cloud-Fog Automation”, 2022.02-2022.06. They won the “Automation Student 2022” prize at the annual contest organized by the Automation Region, Swedish Fair, and Swedish Automation

[M034] Sofie Nilsson (female), Uppsala University, Sweden, “Latency Aware and Event-Based Wireless Control for Cloud-Fog Automation”, 2022.02-2022.06

[M033] Johannes Deivard, Mälardalen University, Sweden, “Diagnostics framework for time-critical control systems in cloud-fog automation”, 2022.01-2022.06

[M032] Valentin Johansson, Mälardalen University, Sweden, “Diagnostics framework for time-critical control systems in cloud-fog automation”, 2022.01-2022.06

[M031] Emil Lindahl, Uppsala University, Sweden, “Towards latency-aware control using 5G and Edge-based control architectures”, 2021.08-2021.12

[M030] Maxx Wallberg, Uppsala University, Sweden, “Towards latency-aware control using 5G and Edge-based control architectures”, 2021.08-2021.12

[M029] Koushik Bhimavarapu, Blekinge Institute of Technology, Sweden, “Performance Analysis and Improvement of 5G based Mission Critical Motion Control Applications” 2021.04-2021.10, currently with ABB Corporate Research, Sweden

[M028] Fangbo Shi, Royal Institute of Technology (KTH), Sweden, “Emerging wireless communication and edge computing for autonomous mobile robots”, 2021.04-2021.10

[M027] Nusrat Hossain (female), Uppsala University, Sweden, 2021.03-2021.08, currently with Ericsson, Sweden

[M026] Florian Haslhofer, Johannes Kepler Universität Linz, Austria, “Safety protocols over real-time wireless network for factory automation and mobile robotics”, 2019.08-2019.09

[M025] Marco Rossanese, University of Padova, Italy, “Real-time wireless for motion control of manipulator and mobile platform in industrial robotics”, 2019.03-2019.11

[M024] Dapeng Lan, Royal Institute of Technology (KTH), Sweden, “Experimental Study of Thread Mesh Network for Wireless Building Automation Systems”, 2016.01-2016.08, currently with Oslo University, Norway

[M023] Eva-Azoidou (female), Royal Institute of Technology (KTH), Sweden, “Modeling and Validation of Power Consumption for Battery-Operated Sensor Devices in Wireless Networks Based on the Thread

- Protocol”, 2016.04-2016.10, currently with Atlas Copco, Sweden
- [M022] Yu Liu, University of Trento, Italy, “Migration from Non-IP to Native-IP Building Automation Networks: Perspective of KNX and Thread”, 2016.04-2016.10, currently with Ericsson Research, Sweden
- [M021] Hui Zhu (female), Royal Institute of Technology (KTH), Sweden, “Evaluation and Research on Gaps in IoTSP Protocols for Building Automation and Smart Grid”, 2015.08-2016.02
- [M020] Binbin Xie, Royal Institute of Technology (KTH), Sweden, “Evaluation and Research on Gaps in IoTSP Protocols for Building Automation and Smart Grid”, 2015.07-2016.02, currently with JD.COM, China
- [M019] Jakob Branger, Linköping University, Sweden, “Standardization Perspectives of Communication Infrastructure for Future Buildings under the Context of IoT and Industrial4.0”, 2015.04-2015.10
- [M018] Asad Raja, Royal Institute of Technology (KTH), Sweden, “High Accuracy Location-Based Services (HiLBS) for Smart and Sustainable Buildings”, 2015.01-2015.07
- [M017] Xiaoyu Min, Aalto University, Denmark, “Low Power Wireless IP Connectivity for Smart Buildings and IoT”, 2015.01-2015.07
- [M016] Shaoling Zhu, Royal Institute of Technology (KTH), Sweden, “Low Power Wireless IP Connectivity for Smart Buildings and IoT”, 2015.01-2015.07
- [M015] Jia Wang (female), Royal Institute of Technology (KTH), Sweden, “RESTfull Web Service Based Engineering Tools for Wireless Home Automation Systems”, 2014.10-2015.04
- [M014] Yuxin Cheng, Sweden, Royal Institute of Technology (KTH), “Hybrid Communication Architecture for IP-based Wireless Home Automation Systems with Both Cloud-Based Mode and Stand-Alone Mode”, 2014.06-2014.12
- [M013] Bruno Silva, University of Pretoria, South Africa, “IR-UWB Based High Accuracy Localization Technology for Industrial Applications”, 2013.09-2014.02
- [M012] Xiaoying Sun, Royal Institute of Technology (KTH), Sweden, Development of a charging management systems for heavy-duty trucks, 2022.1-2022.6
- [M011] Gong Li, Royal Institute of Technology (KTH), Sweden, Universal sensor interface chip solution for wireless sensors, 2012
- [M010] Kang Kai. Royal Institute of Technology (KTH), Sweden, Multi-Source Energy Harvesting for Wireless Sensor Network, 2012
- [M009] Teng Wang, Royal Institute of Technology (KTH), Sweden, Water Quality Monitoring System based on WSN, 2012
- [M008] Shuxiang Xu, Royal Institute of Technology (KTH), Sweden, Protocol Implementation of WSN, 2012
- [M007] Jiahua Zhu, Royal Institute of Technology (KTH), Sweden, The Investigation for Water Quality Sensors, 2012
- [M006] Yin Hua, Royal Institute of Technology (KTH), Sweden, NFC enabled wireless sensor system, 2012
- [M005] Junzhe Tian, Royal Institute of Technology (KTH), Sweden, Prototype of user-centric ubiquitous intelligence based on open platform, 2012
- [M004] Bawei Dai, Royal Institute of Technology (KTH), Sweden, Modeling and Planning of Service-Oriented Wireless Sensor Network, 2012
- [M003] Chengxin Zhao, Royal Institute of Technology (KTH), Sweden, On-site Data Processing Algorithms and Implementation for Wireless Sensor Network, 2011
- [M002] Mohammad Tareq-Ul-Islam. Royal Institute of Technology (KTH), Sweden, Universal Sensor Interface Circuit for Wireless Sensor Network, 2011
- [M001] Xiatao Wang, Royal Institute of Technology (KTH), Sweden, Web-based RFID Tracking System Design and Implementation, 2011

Research Statement

Research Achievements

Zhibo Pang’s research has been focused on intelligent robots and automation systems for Industry4.0 and Healthcare4.0, applying the cross-disciplinary methodology of control-communication-computing co-design. His research is driven by the essential challenges in various industrial verticals, such as healthcare, process

automation, building/home automation, factory/discrete automation, power grids, logistics automation, industrial powertrain, food and beverage, etc. His research achievements are summarized as follows.

Perception, control, and safe interaction of intelligent robots:

- **Robot Skin:** with his team, he developed novel bio-inspired robot skin for collaborative robots (CoboSkin). The CoboSkin integrates for the first time stretchable haptic sensory array, pneumatic actuator array, electronic display array, and capacitive sensor array into a flexible, scalable, and compliant skin layer for robot manipulator which has essentially lifted the safe and affective human robot interaction to the next level. Fundamental challenges in materials, device characterization, decoupling between sensor and actuator, miniaturization, fabrication, and complex wiring and integration have been solved. The results have been published in the WILEY AIS, IEEE TIE, IEEE TMRB, and IEEE JBHI.
- **Robot Vision and Safe Control:** with his team, he developed AI-powered robot vision algorithms for safer robot control and more affective human robot interaction, including the multi-view visual-inertial fusion for safe navigation of mobile robots, the camera and IMU joint calibration, and conditional generative adversarial network (cGAN)-based facial expression recognition. Fundamental challenges in sensors fusion, high precision calibration, low-light image enhancement, and data augmentation of machine learning have been solved. The results have been published in the IEEE TIM, Springer JBE, Elsevier RCIM, and IEEE Access.
- **Latency-Aware Control and Safety Coordination:** with his team, he developed novel network-hardware-in-the-loop simulation, internal mode control (IMC)-inspired latency aware control, and interactive cooperation between fleet management system and network management system for safe control of mobile robots over wireless networks and cloud computing. His work has re-opened the “nearly closed” research question of wireless networked control by re-establishing its foundation on the realistic network and computing conditions. The results have been published in the IEEE TASE, IEEE TII, and granted as European patent EP4320835.

Intelligent robot and automation systems:

- **Mobile Collaborative Robot System:** with his team, he developed one of the earliest mobile dual-arm collaborative robot prototypes with novel teleoperation method based on the hybrid mapping of hand gesture and upper-limb motion for non-professional operators. The prototype was tested in isolated wards during the early stage of the COVID19 pandemic, which was among the earliest trials in the world. Innovations in latency-aware control, reliable networking, safe interaction, safety coordination, robot vision, and virtualized controller have been integrated into the leading industrial product of ABB Mobile YuMi. The results have been published in the IEEE TMRB, IEEE JBHI, IEEE JTEHM, and IEEE RBME.
- **Intelligent Automation Systems:** with his team, he developed various AI-powered automation solutions for vertical industries, such as 3D vision-based surface defect detection and measurement for composite carbon fiber material manufacturing, acoustic bottle defect detection in food and beverage production, voice repairing for elderly and patients with voice disorder, and anomaly detection and autonomous operation in building climate control system. These results are distinguished by their tight integration with physical sensors and actuators and continuous operation in real-world automation system, which have significantly accelerated the adoption of AI in the industrial practices. The results have been published in the IEEE JBHI, IEEE Access, Elsevier RCIM, Elsevier BAE, Elsevier JMS.

Networked and virtualized industrial control infrastructure:

- **Virtualized Industrial and Robotic Controller:** with his team, he was the first to propose the new paradigm of natively AI-enabled industrial and robotic controller by cloud and fog computing (the Cloud/Fog Automation), not only for high level software but also for low-level time-critical control. Fundamental challenges in deterministic virtualization and joint orchestration of control, communication, and computing tasks have been solved with heterogeneous control applications. The proposed architecture has been applied in world leading industrial products such as the ABB new generation 800xA DCS for process automation and the ABB new generation robot controller OmniCore. The roadmap of the Cloud/Fog Automation has also been applied by the Chinese Academy of Science in a grand national research program with 10-billion level of funding. The results have been published in the IEEE TII and IEEE IEM.
- **Cybersecurity and Functional Safety for Industrial Control Systems:** with his team, he developed AI-based algorithms to utilize the channel state information and radio fingerprints for industrial cybersecurity and joint error detection and correction for functional safety by the guessing random additive noise decoding applied to the cyclic redundancy check code (GRAND-CRC). These works

have the potential to re-write the security and safety architecture of today's industrial control systems and are being followed by the largest 6G research center in Sweden, the SweWIN Center. The results have been published in the IEEE TWC, IEEE TII, IEEE IEM, IEEE CL, and IEEE TCE.

- **Wireless Networks for Industrial Control Systems:** with his team, he made major contributions to various industrial wireless technologies with major business impacts. He developed one of the earliest WirelessHART stacks for process automation which has been applied in the ABB WirelessHART products. He developed the highest performance ever wireless-optical control network WirelessHP for power grids and high voltage power electronics equipment, which has been applied in the Hitachi Energy TropOS Wireless products. He improved the latency, reliability, energy efficiency, and security of the Thread Protocol which has become the dominant standard for building and home automation and has been applied in the ABB free@home and ABB Welcome IP products. He recommended key performance and functional improvements for the 5G network to be integrated into industrial control systems which have been adopted by the 3GPP roadmap. In these works, essential challenges in latency optimization, resource allocation and scheduling, security, and low-power design have been solved, not only by theoretical models but also by real-life prototypes. Based on his research, millions of ABB automation products have been produced and installed globally with a revenue of 100+ million EUR. His works have been followed by leading companies such as Intel, Ericsson, Nokia, Bosch, and leading universities such as MIT, Oxford, CalTech, UC Irvine, UPenn, etc. These results have been published in the Proceedings of the IEEE, IEEE JSAC, IEEE TWC, IEEE TII, IEEE Communications, IEEE IEM, and granted as 20+ patents in USA, EU and Japan.

Integrated circuits and system-on-chips: leading 80+ engineers, he developed one of the world earliest single-chip DVB-S (digital video broadcast - satellite) receiver SoC (system-on-chip) in 2005 which had occupied a major share of global market, winning the "National Great Invention Award" awarded by the Ministry of Information Industry of China. Leading 10+ engineers, he developed an application processor SoC with Linux OS and multi-standard high-definition video decoder (H.264, MPEG4, RMVB, etc.) for personal multimedia player in 2008, and developed a network-on-chip (NoC) research platform using FPGA which can implement 64 ARM9 CPU cores in 2009.

Commercialization of Research Results

1. [ABB Ability™ Digital Powertrain – Condition Monitoring](#): cloud-based real-time condition monitoring system for industrial powertrain.
2. [ABB future generation DCS](#): new generation discrete control system for processes automation with native support to virtualization, cloud/fog deployment, and wireless networks.
3. [ABB OmniCore](#): new generation robot controller with native support to cloud/edge computing and AI.
4. [ABB Mobile YuMi](#): intelligent and mobile dual-arm collaborative robots.
5. Disruptive innovations for [HVDC](#) (high-voltage direct current) power transmission solutions, (now Hitachi Energy, formerly ABB Power Grids)
6. [Tropos Wireless Broadband Networks](#) – high reliability low latency wireless network for mission-critical applications in power grids, mining, oil&gas, and city infrastructure (now Hitachi Energy, formerly ABB Power Grids)
7. [ABB-free@home](#) - Building and Home Automation Solution
8. [ABB Welcome IP](#) – video communication solution for residential and functional buildings
9. [ABB WirelessHART instrumentation](#) solutions for process industry
10. [NationalChip System-on-Chip](#) solutions for digital television and consumer electronics

Honors

[H15] Best Interdisciplinary Paper Award, 2024 IEEE Conference on Energy Internet and Energy System Integration (EI2 2024), Shenyang, China, Nov 29 - Dec 2, 2024, for the paper "Minimizing Age-of-Information for Multisystem Energy IoT System with Multiple Subsystems", authored by Xiao Xie, Xiaoling Zhang, Fengxiao Yan, Tianjiao Bai, Zhibo Pang, and Yi Huang.

[H14] Best Paper Award, 2024 IEEE 24th International Conference on Communication Technology in Chengdu, China during October 18-20, 2024, for the paper "Joint Communication Bandwidth and Computing Frequency Allocation for Control-Oriented UAV-Robot Rescue Systems" authored by Daohong Shen, Xinran Fang, Wei Feng, Yunfei Chen and Zhibo Pang.

[H13] My master student, Dongxiao Hu, won the **IES Young Professionals & Students Paper Assistance** at the 33rd International Symposium on Industrial Electronics (ISIE2024), June 18 - 21, 2024, Ulsan, South

- Korea, video. “Embodied AI Through Cloud-Fog Computing A Framework for Everywhere Intelligence”
- [H12] My PhD student, Honghao Lyu, won the **Best Student Paper Finalist Award** in the 16th International Conference on Intelligent Robotics and Applications (ICIRA2023), Hangzhou, China, Jul, 2023.
- [H11] **Runner-up Award**, ABB Process Automation Global HackSummit 2022, “Fog-hosted level-1 control”, team leader and main contributor, there were 6 Winners and 4 Runner-ups out of 62 teams, Nov 23-24, 2022.
- [H10] My master students, Sofie Nilsson and Anna Bengtsson, supervised by me and Alf Isaksson won the “**Automation Student 2022**” prize at the annual contest organized by the Automation Region, Swedish Fair, and Swedish Automation for their thesis on “Latency Aware and Event-Based Wireless Control for Cloud-Fog Automation”, Oct 18, 2022, Gothenburg, Sweden, News and video, the citation of the award is: “The winning entry presents a well-developed model for efficient wireless communication within the manufacturing industry. With scientifically based reasoning and practical tests, the authors contribute new knowledge that is valuable for the development of the future's cost-effective and powerful automation solutions.”
- [H09] My PhD student, Honghao Lyu, won the **IES Young Professionals & Students Paper Assistance** at the 48th Annual Conference of the IEEE Industrial Electronics Society (IECON2022), Oct 18-22, 2022, Brussels, Belgium, video
- [H08] **Inventor of the Year Award**, ABB Corporate Research Sweden, 2021
- [H07] **Inventor of the Year Award**, ABB Corporate Research Sweden, 2018
- [H06] **Inventor of the Year Award**, ABB Corporate Research Sweden, 2016
- [H05] **Outstanding Paper Award**, for “An In-home Medication Management Solution Based on Intelligent Packaging and Ubiquitous Sensing” at the 15th IEEE International Conference on Advanced Communications Technology (ICACT). Jan 2013, Pyeongchang, Korea
- [H04] The **First Place Prize of Competition**, for “TouchMe System, a RFID Solution for Interactive Package” at the RFID Nordic EXPO 2008, Stockholm, Sweden
- [H03] **Second Level Award for Science and Technology of Zhejiang Provence**, Government of Zhejiang Provence, China, 2006
- [H02] **New Century 131 Young Talent**, Government of Hangzhou City, China, 2006
- [H01] **National Significant Invention Award** (as No. 4 among the co-inventors), for the "Satellite/Cable Television Demodulator Chipsets GX1101/GX1001 ", eight projects were awarded country-wide in total, the Ministry of Information Industry of China, China, 2005

Recognition in Ranking Lists

- [R10] No.4305 out of 206482 scientists in Electrical & Electronic Engineering, “World’s Top 2% Scientists – Lifetime Scientific Influence Ranking” by Stanford University and Elsevier Data Repository, Version 7, 2024, doi: 10.17632/btchxktzyw.7
- [R09] No.1348 out of 206482 scientists in Electrical & Electronic Engineering, “World’s Top 2% Scientists - Annual Scientific Influence Ranking” by Stanford University and Elsevier Data Repository, Version 7, 2024, doi: 10.17632/btchxktzyw.7
- [R08] No.1610 out of 111935 scientists in Electrical & Electronic Engineering, “World’s Top 2% Scientists – Lifetime Scientific Influence Ranking” by Stanford University and Elsevier Data Repository, Version 6, 2023, doi: 10.17632/btchxktzyw.6
- [R07] No.374 out of 111935 scientists in Electrical & Electronic Engineering, “World’s Top 2% Scientists - Annual Scientific Influence Ranking” by Stanford University and Elsevier Data Repository, Version 6, 2023, doi: 10.17632/btchxktzyw.6
- [R06] World No.8079, Sweden No.66, in “the Best Scientists in the Field of Computer Science”, RESEARCH.COM, 2022 edition
- [R05] No.1901 out of 106549 scientists in Electrical & Electronic Engineering, “World’s Top 2% Scientists – Lifetime Scientific Influence Ranking” by Stanford University and Elsevier Data Repository, Version 5, 2022, doi: 10.17632/btchxktzyw.5
- [R04] No.345 out of 106549 scientists in Electrical & Electronic Engineering, “World’s Top 2% Scientists - Annual Scientific Influence Ranking” by Stanford University and Elsevier Data Repository, Version 5, 2022, doi: 10.17632/btchxktzyw.5

[R03] No.4052 out of 546033 scientists in Artificial Intelligence & Image Processing, “World’s Top 2% Scientists - Annual Scientific Influence Ranking” by Stanford University and Elsevier Data Repository, Version 4, 2022, doi: 10.17632/btchxktzyw.4

[R02] No.1243 out of 183648 scientists in Networking & Telecommunications, “World’s Top 2% Scientists - Annual Scientific Influence Ranking” by Stanford University and Elsevier Data Repository, Version 3, 2021, doi: 10.17632/btchxktzyw.3

[R01] No.1680 out of 161179 scientists in Networking & Telecommunications, “World’s Top 2% Scientists - Annual Scientific Influence Ranking” by Stanford University and Elsevier Data Repository, Version 2, 2020, doi: 10.17632/btchxktzyw.2

Industry Funded Projects

Most of my research was funded by ABB internally. Project details cannot be provided in this public document.

Public Funded Projects

[PF04] [Co-PI], “Swedish Wireless Innovation Network (SweWIN)”, funded by Vinnova (Swedish Innovation Agency) competence center project 2023-00572, 2023.11-2028.12, 27.7M SEK from Vinnova and 90M SEK total budget, Zhibo Pang as co-PI is leading the research area of “wireless functional safety” with 5M SEK from Vinnova and 10MSEK total budget.

[PF04] [PI], “Making the wireless critical control safe and resilient”, funded by Swedish Foundation for Strategic Research (SSF) project APR20-0023, 2021.05-2027.04, 1.5MSEK from SSF,

[PF03] [Senior Member (responsible for strategy, result review, and IPR)], PRJ-7646: ABB part of the H2020 project 5G SMART – 5G for smart manufacturing (<https://5gsmart.eu/>), 2019.06-2021.12, 10.2MEUR (EU in total), 500kUSD (ABB part),

[PF02] [PI], VINNOVA 2015-06548: Ultra-High Performance Wireless Communications for Industrial Applications, funded by Swedish Innovation Agency (VINNOVA), 2016.01-2017.06, 191kSEK

[PF01] [PI], VINNOVA 2017-02822: Ultra-Reliable Low Latency Wireless Communications for Industrial Digitalization, funded by Swedish Innovation Agency (VINNOVA), 2017.08-2018.01, 296kSEK,

Invited Talks at International Conferences

Zhibo Pang has delivered 45+ invited presentations at international conferences in 15+ countries, including 11 funded keynotes and plenary speeches.

The keynotes or invited talks were delivered at the following IEEE conferences: ETFA2024 Italy, ICIEA2024 Norway, ICIT2024 UK, 6G Summit 2024 Germany, XIII BSCSE2023 Brazil, WS of WF-IoT2022 Japan, IECON2022 Belgium, ISIE2022 USA, ISIE2021 Japan, WS of ICC2021 Canada, VTC2021-Spring Finland, Globecom2020 Taiwan, WS of ICC2020 Ireland, 5G World Forum 2020 India, ICII2019 USA, INDIN2019 Finland, ISIE2019 Canada, WCNC2018 Spain, GLOBECOM 2017 Singapore, MDBS2017 China, VTC2017-Spring Australia, SAS2017 USA, Cybermatics2016 China, ES2016 Australia, IECON2016 Italy, IEEE Industry Tech Summit 2016 USA, INDIN2016 France, IEEE Smart City 2015 China,

The keynotes or invited talks were delivered at the following non-IEEE conferences: NIST Wireless Workshop 2024 online, ISSET 2024 China, FAAI 2024 China, 5G-ACIA 27th Plenary Meeting2023 Sweden, International Summit on Industrial Intelligence 2022 China, FAAI 2021 China, FAAI 2020 China, Data Innovation Summit 2019 Sweden, AusCTW2019 Australia, GRC-AHI2018 Hong Kong, ITG WSA2017 Germany, EAI WICON2016 China, SmartX2016 China, International Forum on Innovative Cities 2016 China, LCES2013 China

[T048] [Invited Talk] “Functional Safety Communication over Deterministic Wireless Networks”, NIST Workshop on Advanced Technologies and Use Cases for High-performance Industrial Wireless Systems, September 12, 2024, online

[T047] [Invited Talk] “Functional Safety Communication over Deterministic Wireless Networks”, 29th IEEE International Conference on Emerging Technologies and Factory Automation (ETF2024), 10th-13th September 2024, Padova, Italy

[T046] [**Funded Keynote**] “From open 5G to embodied intelligence: new progresses on the Cloud/Fog Automation”, The 2024 3rd International Symposium on Semiconductor and Electronic Technology (ISSET 2024), August 23-25, 2024 in Xi’an, China.

[T045] [**Funded Distinguished Lecture**] “From open 5G to embodied intelligence: new progresses on the Cloud/Fog Automation”, The 6th International Forum on Frontiers of Automation and Artificial Intelligence (FAAI 2024), August 21-24, 2024, Shenyang, China

- [T045] [**Funded Distinguished Lecture**] “Cloud/Fog Automation: can the level-1 control be hosted in cloud computing?”, The 19th IEEE Conference on Industrial Electronics and Applications (ICIEA 2024), 05-08 August 2024, in Kristiansand, Norway
- [T044] [Invited Talk] “5G/6G for industrial control systems: a new starting point”, IEEE 6G Summit Dresden 2024, May 13–14, 2024 in Dresden, Germany
- [T043] [**Funded Keynote**] “Cloud/Fog Automation: the New Paradigm of Industrial Automation Calling for Cross-disciplinary Research”, at the IES Students and Yong Professionals Forum of the 25th IEEE International Conference on Industrial Technologies (ICIT2024), Mar 25-27, 2024, Bristol, UK
- [T042] [**Funded Keynote**] “Communication-Computing-Control Co-Design for the Cloud Fog Automation: a New Paradigm of Realizing Industrial Automation Systems”, XIII Brazilian Symposium on Computing Systems Engineering, Nov 21-24, 2023, Porto Alegre – RS, Brazil
- [T041] [**Keynote**] “5G for industrial control systems: a critical reflection”, 27th Plenary Meeting of the 5G Alliance for Connected Industries and Automation (5G-ACIA), Sep 19-21, 2023, Stockholm, Sweden
- [T040] [**Keynote at Workshop**] “Time Critical IoT for Industrial Automation: the Communication and System Perspectives”, Workshop on the Internet of Time-Critical Things at the IEEE 8th World Forum on Internet of Things (WF-IoT2022), 26 October–11 November 2022, Yokohama, Japan
- [T039] [Invited Speaker] “Unobtrusive evaluation of latency and reliability of industrial wireless technologies”, Workshop on Industrial Wireless Technologies and Systems at the 48th Annual Conference of the IEEE Industrial Electronics Society (IECON2022) on October 17, 2022, Brussels, Belgium.
- [T038] [Invited Speaker] “5G communication and computing for industrial control systems: where we are and directions”, Industry Forum (IF) at the 48th Annual Conference of the IEEE Industrial Electronics Society (IECON2022) on October 18 - 20, 2022, Brussels, Belgium.
- [T037] [Invited Speaker] “Impulsive noise and interference in industrial wireless systems: A perspective of non-communication sources”, 31st IEEE International Symposium on Industrial Electronics (ISIE2022), June 1-3, 2022, online and Anchorage, Alaska, USA
- [T036] [Invited Speaker] “New initiatives and challenges towards open architecture for process automation”, The 2nd International Summit on Industrial Intelligence, Jun 18-19, 2022, online and Shenyang, China
- [T035] [**Funded Distinguished Lecture**] “Cloud-Fog Automation: New trends in industrial automation powered by deterministic communication and computing”, 3rd International Forum on Frontiers of Automation and Artificial Intelligence (FAAI 2021), online and Nov 8-9,2021, in Shenyang, China
- [T034] [Invited Speaker] “New trends in communication and computing technologies towards the Cloud-Fog Automation”, the 30th IEEE International Symposium on Industrial Electronics (ISIE2021), online and Kyoto, Japan, June 20-23, 2021.
- [T033] [**Keynote at Workshop**] “WirelessHP: towards the Ethernet-grade wireless for critical control in industrial automation”, IEEE International Conference on Communications (ICC2021) Workshop on Extreme URLLC Towards 6G Connectivity, 14-23 June 2021, online and Montreal, Canada
- [T032] [Tutorial] “5G and Beyond for Robotics and Automation: Challenges and Opportunities”, The 2021 IEEE 93rd Vehicular Technology Conference (VTC2021-Spring), 25 - 28 April 2021, Helsinki, Finland
- [T031] [**Funded Distinguished Lecture**] “5G for Industrial Automation and AI: Applications and Challenges”, 2nd International Forum on Frontiers of Automation and Artificial Intelligence (FAAI 2020), October 22-23,2020, in Shenyang, China
- [T030] [Tutorial] “Ultra-Reliable and Low-Latency Communications for Industry 4.0: Industrial and Academic Perspectives”, IEEE Global Communications Conference (Globecom2020), 8–10 December 2020, Taipei, Taiwan
- [T029] [**Keynote at Workshop**] “Wireless for critical control in industrial systems: use cases, gaps, and research directions”, 2020 IEEE International Conference on Communications (ICC2020) Workshop on 5G Long Term Evolution and Intelligent Communication, Dublin, Ireland (changed to virtual), 7-11 June 2020
- [T028] [Tutorial] “High performance wireless (WirelessHP) for critical control in industrial automation”, The IEEE 5G World Forum 2020, Bangalore, India (changed to virtual), Sep 10-12, 2020
- [T027] [Panel Talk] “High Performance Wireless Connectivity for Industrial Internet”, the 2nd IEEE International Conference on Industrial Internet (ICII2019), Orlando, USA, Nov 11-12, 2019
- [T026] [Panel Talk] “Industrial Communication and Edge Computing in the Era of AI”, The IEEE International Conference on Industrial Informatics (INDIN2019), Helsinki, Finland, July 23-25, 2019

- [T025] [Invited Talk] “Last Mile Connectivity: the Bottleneck of Mission Critical Industrial IoT”, Workshop on Reliable and High Performance Wireless Systems for Factory Automation at the IEEE 28th International Symposium on Industrial Electronics (ISIE2019), Vancouver, Canada, June 13-14, 2019
- [T024] [Invited Talk] “Last Mile Connectivity for Critical Industrial IoT: to Close the Loop from Big Data to Big Value”, Data Innovation Summit 2019, Stockholm, Sweden, Mar 14-15, 2019
- [T023] [**Keynote**] “Last Mile Connectivity: the Bottleneck of Critical Industrial IoT”, The 19th Australian Communications Theory Workshop (AusCTW), Sydney, 6-8 February 2019.
- [T022] [**Funded Invited Speaker**] “Closed-Loop Sensing, Actuation and AI for Eldercare Robotics”, Gordon Research Conference on Advanced Health Informatics (GRC-AHI2018), June 17, 2018 - June 22, 2018, Hong Kong, China.
- [T021] [Panel Talk] “WirelessHP (High Performance): A New Target of Industrial Wireless for Control”, IEEE Wireless Communications and Networking Conference (WCNC2018), 15-18 April 2018, Barcelona, Spain
- [T020] [Panel Talk] “Wireless HP (High Performance): a New Target of Industrial Wireless for Control Systems”, IEEE GLOBECOM 2017, 4-8 December 2017, Singapore
- [T019] [Judge of Contest] ABB China University Innovation Contest 2018, Sep 25, 2018, Beijing, China
- [T018] [Panel Talk] Ericson Open Research Day, May 16, 2017, Stockholm, Sweden
- [T017] [**Funded Keynote**] The 11th IEEE-EMBS International Summer School and Symposium on Medical Devices and Biosensors (MDBS' 2017), Shenzhen, China, on July 07 - July 11, 2017,
- [T016] [**Keynote at Workshop**] IEEE 85th Vehicular Technology Conference: VTC2017-Spring, 4–7 June 2017, Sydney, Australia
- [T015] [Panel Talk] IEEE Sensors Applications Symposium (SAS2017), Mar 13-15, Glassboro, NJ, USA
- [T014] [Invited Plenary Speech] The 21st International ITG Workshop on Smart Antennas (WSA2017), Mar 15-17, Berlin, Germany
- [T013] [Plenary Speech] “Towards Real Time Wireless Cyber Physical Systems”, 9th EAI International Wireless Internet Conference (WICON), Haikou, China, Dec 2016
- [T012] [Plenary Speech] “Unlock the Deployment of Cyber Physical Systems by Real-Time Wireless Communications”, the 2016 World Cybermatics Congress (Cybermatics 2016) Dec. 16-19, 2016, Chengdu, China
- [T011] [Plenary Speech] “Towards Real Time Wireless Cyber Physical Systems”, The 4th International Conference on Enterprise Systems (ES2016), Melbourne, Australia / 2-3 November, 2016
- [T010] [Plenary Speech] “Replace the Optical Fiber by wireless for real-time CPS? - Industrial perspective, challenges and directions”, The 42nd Annual Conference of IEEE Industrial Electronics Society (IECON2016), October 24-27, 2016, Firenze (Florence), Italy
- [T009] [**Funded Keynote**] “Towards the Real-Time Cyber Physical Systems for Smarter Living and Production Facilities”, The 2016 International Conference on SmartX on 29-31 July 2016, in Dalian, China
- [T008] [Panel Talk] “Connectivity for future buildings towards the Internet of Things, Services and People: trends and challenges”, IEEE Industry Tech Summit, Jun 6-7, 2016, Santa Clara, USA
- [T007] [**Funded Plenary Speech**] “Industrial Internet of Things, Services, and People for Innovative Cities Driven by the Industry4.0”, 2016 International Forum on Innovative Cities, July 16-17, Shenzhen, China
- [T006] [Tutorial] “Industrial Informatics for Future Buildings and Homes”, 14th IEEE International Conference on Industrial Informatics (INDIN2016), 18-21 July 2016, Futuroscope-Poitiers, France
- [T005] [Invited Tutorial] “Industrial perspectives of future buildings under the context of internet-of-Things and Industry4.0”, IEEE Smart City 2015 Conference, Dec 2015, Chengdu, China
- [T004] [Invited Speech] “How big are the data in the era of Industrial Internet of Things (I-IoT) and Industry 4.0”, China-Northern Europe Conference on Big Data – Journal of Management Informatics special issue on Big Data Methods and Applications, Aug 3-4, 2015, Stockholm, Sweden
- [T003] [Plenary Speech] “Business-Technology Co-Design on Industrial Internet-of-Things”, IEEE Conference on Enterprise Systems (ICES2014), Aug 2014, Shanghai, China
- [T002] [Invited Speech] “Research on the Industrial Internet-of-Things for Sustainability”, Low Carbon Earth Summit(LCES2013), Sep 2013, Xi'an, China

[T001] [Invited Lecture] "Research on the Industrial Internet-of-Things (I-IoT)", EIT ICT Labs Summer School on Internet of Things 2014, July 2014, Stockholm, Sweden

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[D2] Zhibo Pang, "Technologies and Architectures of the Internet-of-Things (IoT) for Health and Well-being", PhD Thesis, KTH Royal Institute of Technology, Stockholm, Sweden, 2013

[D1] Zhibo Pang, "Business Model Design for Personal Mobile Healthcare Service: the Methodology and Case Study", MBA Thesis, University of Turku, Turku, Finland, June 2012.

Authored or Edited Books

[B02] Hans-Peter Bernhard, and Zhibo Pang, Proceedings of the 17th IEEE International Workshop on Factory Communication Systems (WFCS 2021) - Communication in Automation, IEEE, 2021

[B01] Zhibo Pang, Lefei Li, and Gang Li, Proceedings of the 5th International Conference on Enterprise Systems (ES2017) - Industrial Digitalization by Enterprise Systems, IEEE, 2017

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[J127] Ruonan Liu, Puyuan Hu, Siheng Zhao, Zhijian Sun, Te Han, Zhibo Pang, and Weidong Zhang, "Out-of-Distribution Fault Diagnosis of Industrial Cyber-physical Systems Based on Orthogonal Anchor Clustering with Adaptive Balance", IEEE Transactions on Industrial Cyber-Physical Systems, 2024

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[P034] Zhibo Pang, Michele Luvisotto, Fei Pan, Ming Xiao, Roger Jansson, “Method of authentication of wireless communication based on physical layer security”, International Patent PCT published as US11877153B2, EP19162697.7, Assignee: ABB Technology Ltd, Filed 2020-03-11, Granted: 2024-01-16. (Core innovation: Physical layer authentication against spoofing).

[P033] Zhibo Pang, Michele Luvisotto, Roger Jansson, “Radio-based detector and method to protect against unpredictable interference in industrial wireless communications”, International Patent PCT published as EP19156813.8, US11664922B2, Assignee: Hitachi Energy Switzerland AG, Filed 2019-02-13, Granted in US: 2023-05-30. (Core innovation: fast jamming detection by radio circuits without baseband processing).

[P032] Zhibo Pang, Xiaolin Jiang, Michele Luvisotto, Dacfe Dzong, Roger Jansson, Carlo Fischione, “Route Selection in a Wireless Communication System”, International Patent PCT published as WO-2019242943-A1, US11582675B2, Assignee: Hitachi Energy Switzerland AG, Filed: 2019-05-15, Granted in US: 2023-02-14. (Core innovation: to enable the WirelessHP-based control of critical automation systems, ultra-short latency

¹ Only one item is listed here if the patent application is filed or granted in multiple countries using different numbers. Some of the items are hidden as they are still in the confidential stage of the patent lifecycle.

is required, and this makes the delay spread unneglectable due to multipath effect during radio signal propagation. In some cases, two hops via the wireless channels with shorter delay spread may result in shorter latency than single hop via the channels with larger delay spread. We select the optimal links and physical layer structure and parameters e.g. the length of cyclic prefix based on the characterization of the wireless channel e.g. the delay spread. The overall method is called CCDO-- channel characterization-based delay optimization).

[P031] Zhibo Pang, Michele Luvisotto, Dacfe Dzong, “Packet detection and timing synchronization for high performance wireless communications in substation automation”, International Patent PCT published as WO-2019158181-A1, US11546199B2, Assignee: Hitachi Energy Switzerland AG, Filed: 2018-02-13, Granted in US: 2023-01-03. (Core innovation: to enable the WirelessHP-based control of substation automation systems, single OFDM symbol is applied as preamble of physical layer packet but this makes it more difficult to detect the received from the background noises and interferences by the receiver. We exploit the OFDM symbol and predict the time to start packet detection based on the available scheduling information to further reduce the probability of false alarm).

[P030] Zhibo Pang, Michele Luvisotto, Dacfe Dzong, “Frequency offset estimation and compensation for high performance wireless communications in substation automation”, International Patent PCT published as WO-2019158182-A1, US11489710B2, Assignee: Hitachi Energy Switzerland AG, Filed: 2018-02-13, Granted in US: 2022-11-01. (Core innovation: to enable the WirelessHP-based control of power grids automation systems, single OFDM symbol is applied as preamble of physical layer packet but this makes it more difficult to estimate and compensate the carrier frequency error by the receiver. We exploit the cyclic prefix of each OFDM symbol and accumulate the error extracted from multiple time slots based on the available scheduling information to further improve the accuracy of error estimation).

[P029] Zhibo Pang, Michele Luvisotto, Xiaolin Jiang, Roger Jansson, Carlo Fischione, “Method and system of wireless TDMA scheduling for industrial machine-to-machine communication, including propagation-delay-aware scheduling”, International Patent PCT published as EP19166510.8, US11438856B2, Assignee: Hitachi Energy Switzerland AG, Filed 2019-04-01, Granted in US: 2022-09-06. (Core innovation: Method to help the scheduler in industrial networks to improve bandwidth utilization by propagation-delay-aware pipelined transmissions, by scheduling considering propagation-delay for distant nodes).

[P028] Zhibo Pang, Michele Luvisotto, Roger Jansson, “Method and system of wireless TDMA communication for industrial machine-to-machine communication”, International Patent PCT published as EP19162695.1, US11424890B2, Assignee: Hitachi Energy Switzerland AG, Filed 2019-03-14, Granted in US: 2022-08-23. (Core innovation: Group and piggybacked acknowledgement and synchronization in industrial wireless communications. PTP-like clock sync using only beacon and uplink data, no dedicated sync packet,).

[P027] Zhibo Pang, Michele Luvisotto, Roger Jansson, “Method for allocating resources in a wireless communication system”, International Patent PCT published as EP19158242.8, US20220110113A1, JP7279178B2, Assignee: Hitachi Energy Switzerland AG, Filed 2019-02-20, Granted in Japan: 2023-05-22. (Core innovation: packet fragmentation and aggregation by reconfiguring PHY parameters in industrial wireless communications).

[P026] Henrik Hellström, Marek Czepulonis, Michele Luvisotto, Zhibo Pang, Roger Jansson, “Symbol-level fragmentation and pre-emption in industrial wireless communications”, International Patent PCT published as EP20154825.2, EP3860288A1, US20210243646A1, JP7333355B2, Assignee: Hitachi Energy Switzerland AG, Filed 2020-01-31, Granted in Japan: 2023-08-24 (Core innovation: Symbol-level fragmentation and pre-emption in industrial wireless communications).

[P025] Zhibo Pang, Michele Luvisotto, “Channel access in an industrial wireless network”, International Patent PCT published as WO-2019192683-A1, US11963216B2, EP3777434B1, Assignee: Hitachi Energy Switzerland AG, Filed: 2018-04-04, Published: 2019-11-20, Granted in EU: 2022-03-23. In US: 2024-04-16 (Core innovation: to enable the WirelessHP-based control of critical automation systems, centralized scheduling and radio resource allocation is combined with local resource allocation to efficiently utilize the channel resources for achieving ultra-short latency).

[P024] Zhibo Pang, Xiaolin Jiang, Michele Luvisotto, Roger Jansson, Carlo Fischione, “Scheduling-transparent time-shifted duplicated network to improve availability”, International Patent PCT published as US 11,337,236 B2, EP19155673.7, Assignee: Hitachi Energy Switzerland AG, Filed 2019-02-06, Granted in US: 2022-05-17. (Core innovation: time-shifted scheduling for duplicated network).

[P023] Zhibo Pang, Michele Luvisotto, Roger Jansson, “Method to efficiently handle low latency cyclic data inside a wireless communication node between communication interface and applications within node while maintaining data consistency and handling communication errors efficiently”, International Patent PCT published as US 11,233,624 B2, EP19155669.5, Assignee: ABB Technology Ltd, Filed 2019-02-06, Granted in US: 2022-01-25. (Core innovation: hardware MAC and software MAC interfaced by shared memory with

batch processing).

- [P022] Zhibo Pang, Nan Chen, Mikael Davidsson, Michele Luvisotto, “Valve unit with wireless interface for high-voltage power electronics system”, International Patent PCT published as US 11,289,792 B2, EP 19162288.5, Assignee: ABB Technology Ltd, Filed: 2019-03-12, Granted: 2022-03-29. (Core innovation: installation of wireless antenna in HVDC valve and installation of wireless RF cell separated from HVDC hall).
- [P021] Zhibo Pang, Michele Luvisotto, “Automatic gain control in a wireless communication network for power grid control”, International Patent PCT published as WO2019158183, CN111713015 EP3753104 US 11,025,217 B2, EP2018705872, Assignee: ABB Technology Ltd, Filed: 2018-02-13, Published: 2019-10-02. Granted: 2021-06-01, (Core innovation: to enable the WirelessHP-based control of power grids automation systems, ultra-short packet is applied but this makes it more difficult to estimate the received signal strength and control the gain of analog amplifier by the receiver. We signal strength of each packet and accumulate across multiple time slots based on the available scheduling information to improve the accuracy of estimation).
- [P020] Zhibo Pang, Dacfez Dzung, Mikael Davidsson, “Communications network for communication between a control unit and a power electronics element”, International Patent PCT published as WO-2018210413, US 11,075,720 B2, EP3625914 B1, CN110915155, Assignee: ABB Technology Ltd, Filed: 2017-05-16, Granted: 2021-07-27, (Core innovation: to enable the WirelessHP-based control of high voltage power electronics systems like the HVDC power converter, acknowledgement from each switching device is transmitted to the controller concurrently by CDMA and forwarded more efficiently through multi-hop network to reduce the round-trip latency and occupied channel resources)
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- [P018] Zhibo Pang, Dacfez Dzung, Mikael Davidsson, “Communications network for communication between a power electronics element and a control unit”, International Patent PCT published as US 11,177,857 B2, WO-2018113960, CN-110168832, EP-3560058 B1, Assignee: ABB Technology Ltd, Filed 2016-12-21, Granted: 2021-11-16. (Core innovation: using short latency, high reliability and multi-hop WirelessHP network to transmit control commands for the switching signals of power electronics devices like IGBT in high voltage power electronics systems like HVDC converter).
- [P017] Zhibo Pang, Gargi Bag, Morgan Johansson, “Health report sending from a wireless communication network”, International Patent PCT WO-2017092825-A1, DE-112015007164-T5, US10708800B2, Assignee: ABB Technology Ltd, Filed 2015-12-04, Granted: 2020-07-07. (Core innovation: sending the health status of IWSN devices for on-site diagnosis through a second protocol e.g. BLE without interrupting the communication of the main protocol e.g. Thread during operation in building automation systems)
- [P016] Zhibo Pang, Gargi Bag, Morgan Johansson, “Installation of building automation devices”, International Patent PCT published as WO 2017092802 A1, EP3384633, US11431521B2, Assignee: ABB Technology Ltd, Filed 2015-12-02, Granted: 2020-11-04. (Core innovation: an added functionality in a mobile device that uses location information to help install devices in correct place, pair physically close by devices as corresponding nodes, and assign common security parameter for devices located close by for group communication).
- [P015] Gargi Bag, Zhibo Pang, Morgan Johansson, “Managing communication between gateway and building automation device by installing protocol software in gateway”, International Patent PCT published as WO 2017084719 A1, EP3378192, US10892908B2. Assignee: ABB Technology Ltd, Filed 2015-11-20, Granted: 2021-10-06. (Core innovation: download and install the protocol software from server to the gateway so that the gateway can support multiple IWSN protocols with lower cost and become future proof).
- [P014] Gargi Bag, Zhibo Pang, Morgan Johansson, “Managing communication between gateway and building automation device”, International Patent PCT published as WO 2017084718 A1, EP3378191, US11424948B2 Assignee: ABB Technology Ltd, Filed 2015-11-20, Granted: 2021-01-27. (Core innovation: reconfigure the IWSN device by the gateway through a default PHY/MAC mode so that the device can run another PHY/MAC protocol with lower cost and become future proof in building automation systems).
- [P013] Mikael Gidlund, Johan Åkerberg, Zhibo Pang, Kan Yu, “Determination of communication routes in a wireless communication network”, International Patent PCT published as WO2014005754, US9338058B2, US2015156070, EP2683199, CN104685931B, CN104685931, PL2683199T, IN2015CN17A, Assignee: ABB Research Ltd, Filed 2012-07-05, Granted: 2016-05-10 (Core innovation: using directional flooding to replace conventional routing in IWSN for better reliability and latency)

- [P012] Jun Chen, Zhijie Huang, Zhibo Pang, “A Method to display multiple images in the same screen”, Chinese Patent ZL200610098901.4, Assignee: Guoxin Science & Technology Co, Filed 2006-07-14, Granted 2010-05-12. (Core innovation: sophisticated arrangement of memory space to store the picture-in-picture image data, which largely reduces the required SDRAM space of digital television.)
- [P011] Yuqing Zhong, Zhibo Pang, “Method for showing animation effect”, Chinese Patent ZL200610098909.0, Assignee: Guoxin Science & Technology Co, Filed 2006-07-14, Granted 2009-09-16. (Core innovation: periodically change the contents of color table to dynamically map the coded/compressed graphical user interface data to actual displayed image, which enables more flexible animation effects for UI design of digital television with minimized cost.)
- [P010] Zhibo Pang, Ding Zhang, Xiaowei Huang, “Video decoding method”, Chinese Patent ZL200610098904.8, Assignee: Guoxin Science & Technology Co, Filed 2006-07-14, Granted 2008-10-01. (Core innovation: decode the B frame of MPEG video stream twice instead of once, which enables radical reduction of required memory space to 2~3 decoded image frames.)
- [P009] Zhibo Pang, Ding Zhang, Xiaowei Huang, “Method to generate the preview images”, Chinese Patent ZL200610098903.3, Assignee: Guoxin Science & Technology Co, Filed 2006-07-14, Granted 2008-08-27. (Core innovation: apply frequency domain filtering to the DCT parameters during decoding, then apply 2D smooth filtering during playback, which largely reduces complexity to generate down sampled preview image of MPEG video stream.)
- [P008] Jian Liang, Zhibo Pang, Mengyao Zhu, “Method for video and audio synchronization”, Chinese Patent ZL200610098906.7, Assignee: Guoxin Science & Technology Co, Filed 2006-07-14, Granted 2008-11-26. (Core innovation: extra timestamps from the multiplexed MPEG audio and video streams and save them together with the demultiplexed streams respectively, then synchronize the audio and video streams based on these timestamps during decoding and playback.)
- [P007] Zhibo Pang, Bingbo Li, Xiaowei Huang, “Method to improve the SDRAM bus efficiency in video decoder”, Chinese Patent ZL200610098907.1, Assignee: Guoxin Science & Technology Co, Filed 2006-07-14, Granted 2008-12-17. (Core innovation: ping-pong operation of reading and writing SDRAM for decoding MPEG video stream, which largely increases the bandwidth efficiency of the SDRAM bus.)
- [P006] Zhibo Pang, Bingbo Li, Mingchao Ma, “Storage management method for video decoding”, Chinese Patent ZL200610098905.2, Assignee: Guoxin Science & Technology Co, Filed 2006-07-14, Granted 2008-10-22. (Core innovation: sophisticated arrangement of SDRAM memory space for decoding and playing back MPEG video stream which only requires 2~2.5 frames stored in the memory. This method radically reduces the cost of SDRAM from 32Mb to 16Mb.)
- [P005] Xiaowei Huang, Zhibo Pang, Ding Zhang, “Method to record the booting images”, Chinese Patent ZL200610098902.9, Assignee: Guoxin Science & Technology Co, Filed 2006-07-14, Granted 2008-10-22. (Core innovation: using hardware accelerator to capture an highly compressed inner frame from the MPEG2 video stream as booting image of the TV set-top-box, then play it back during the boot of the set-top-box. This method provides more user friendly design of software with minimized cost.)
- [P004] Zhijie Huang, Zhibo Pang, Ming Zhang, “Automatic channel searching method in digital Tv-set”, Chinese Patent ZL200410054279.8, Assignee: Guoxin Science & Technology Co, Filed 2004-09-03, Granted 2007-10-10. (Core innovation: use narrow band filter to scan the spectrum of receiver QAM/PSK signals, then recognize a valid TV channel is there if the spectrum meets a certain pattern, then start fast timing and carrier recovery operation until the scan of the whole band is finished. This method enables fast and blind scan/discovery of valid digital TV signals in a wide spectrum.)
- [P003] Zhibo Pang, Zhijie Huang, Ming Zhang, “Method to improve timing recovery lock detecting”, Chinese Patent ZL200410054276.4, Assignee: Guoxin Science & Technology Co, Filed 2004-09-03, Granted 2008-04-02. (Core innovation: use a FIFO structure to replace the traditional IIR filter to implement the low pass filter of the timing recovery loop of QAM/PSK signals. This method can achieve both smoothness and responsiveness of the timing recovery loop, which is important for fast signal/channel search.)
- [P002] Zhijie Huang, Zhibo Pang, Ming Zhang, “A method of timing recovery”, Chinese Patent ZL200410054277.9, Assignee: Guoxin Science & Technology Co, Filed 2004-09-03, Granted 2008-02-06. (Core innovation: select useful half-symbol and full-symbol samples from the I and Q components by applying a selectin window according to their amplitude and phase, then extract the time recovery error from the selected I/Q samples. This method can enable fast timing recovery of QAM/PSK signals with very large carrier frequency error which is important for fast signal/channel search.)
- [P001] Zhibo Pang, Zhijie Huang, Ming Zhang, “A lock detecting method in timing recovery for QAM and PSK signals”, Chinese Patent ZL200410054278.3, Assignee: Guoxin Science & Technology Co, Filed 2004-09-03, Granted 2008-04-02. (Core innovation: calculate the average radius of the half-symbol samples and

full-symbol samples of the I and Q components of QAM/PSK signals, the timing recovery loop is seen as locked when the difference between these two average values is big enough. This method can largely increase the reliability and timeliness of the detection which is important for fast signal/channel search.)

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- Dr. Alf Isaksson, Corporate Research Fellow, ABB Corporate Research Sweden, Forskargrand 7, 721 78 Vasteras, Sweden, +46 21 323224, alf.isaksson@se.abb.com
- Dr. Mikael Dahlgren, Director, ABB Corporate Research Sweden, Forskargrand 7, 721 78 Vasteras, Sweden, +4621323276, mikael.dahlgren@se.abb.com
- Prof. Mikael Skoglund, Head of Department, Department of Intelligent Systems, KTH Royal Institute of Technology, Malvinas Väg 10, Stockholm, 11428, Sweden, +46 8 790 84 30, skoglund@kth.se
- Prof. Branka Vucetic, Director of the Centre for IoT and Telecommunications, The University of Sydney, J13 - Engineering Link Building, 330 Anzac Parade, Kensington NSW 2033, Australia, +61 2 9351 3514, branka.vucetic@sydney.edu.au
- Dr. Richard Candell, Lead of Industrial Wireless Systems, National Institute of Standards and Technology (NIST), 100 Bureau Drive, MS 8230, Gaithersburg, MD 20899, USA, +1-301-975-4287, rick.candell@nist.gov
- Dr. Dacfe Dzong, Corporate Research Fellow (retired), ABB Corporate Research Switzerland, dacfe.dzung@gmail.com
- Prof. Preben E. Mogensen, Bell Labs Fellow, Nokia, Fredrik Bajers Vej 7, A4-204, 9220 Aalborg, Denmark, +45-9940 8658, preben.mogensen@nokia.com
- Prof. Axel Jantsch, Professor in Systems on Chip, Institute of Computer Technology, TU Wien, Gußhausstraße 27-29, 1040 Wien, Austria, +43 1 58801 38415, axel.jantsch@tuwien.ac.at