# PROCEEDINGS OF SPIE

# Sixth International Conference on Electronics and Information Engineering

**Qiang Zhang** 

Editor

26–27 September 2015 Dalian, China

Organized by Dalian University (China)

Sponsored by
Key Laboratory of Advanced Design and Intelligent Computing (Dalian University)
Ministry of Education (China)

Published by SPIE

Volume 9794

Proceedings of SPIE 0277-786X, V. 9794

SPIE is an international society advancing an interdisciplinary approach to the science and application of light.

The papers in this volume were part of the technical conference cited on the cover and title page. Papers were selected and subject to review by the editors and conference program committee. Some conference presentations may not be available for publication. Additional papers and presentation recordings may be available online in the SPIE Digital Library at SPIEDigitalLibrary.org.

The papers reflect the work and thoughts of the authors and are published herein as submitted. The publisher is not responsible for the validity of the information or for any outcomes resulting from religionce thereon.

Please use the following format to cite material from these proceedings:

Author(s), "Title of Paper," in *Sixth International Conference on Electronics and Information Engineering*, edited by Qiang Zhang, Proceedings of SPIE Vol. 9794 (SPIE, Bellingham, WA, 2015) Six-digit Article CID Number.

ISSN: 0277-786X

ISSN:1996-756X (electronic) ISBN: 9781510600294

Published by

SPIE

P.O. Box 10, Bellingham, Washington 98227-0010 USA Telephone +1 360 676 3290 (Pacific Time) · Fax +1 360 647 1445 SPIE.ora

Copyright © 2015, Society of Photo-Optical Instrumentation Engineers.

Copying of material in this book for internal or personal use, or for the internal or personal use of specific clients, beyond the fair use provisions granted by the U.S. Copyright Law is authorized by SPIE subject to payment of copying fees. The Transactional Reporting Service base fee for this volume is \$18.00 per article (or portion thereof), which should be paid directly to the Copyright Clearance Center (CCC), 222 Rosewood Drive, Danvers, MA 01923. Payment may also be made electronically through CCC Online at copyright.com. Other copying for republication, resale, advertising or promotion, or any form of systematic or multiple reproduction of any material in this book is prohibited except with permission in writing from the publisher. The CCC fee code is 0277-786X/15/\$18.00.

Printed in the United States of America.

Publication of record for individual papers is online in the SPIE Digital Library.



**Paper Numbering:** Proceedings of SPIE follow an e-First publication model. A unique citation identifier (CID) number is assigned to each article at the time of publication. Utilization of CIDs allows articles to be fully citable as soon as they are published online, and connects the same identifier to all online and print versions of the publication. SPIE uses a six-digit CID article numbering system structured as follows:

- The first four digits correspond to the SPIE volume number.
- The last two digits indicate publication order within the volume using a Base 36 numbering system employing both numerals and letters. These two-number sets start with 00, 01, 02, 03, 04, 05, 06, 07, 08, 09, 0A, 0B ... 0Z, followed by 10-1Z, 20-2Z, etc. The CID Number appears on each page of the manuscript.

# **Contents**

xi	Authors
XV	Conference Committee
xix	Introduction
SESSION 1	SIGNAL DETECTION
9794 02	Non-contact cardiac pulse rate estimation based on web-camera (Invited Paper) [9794-105]
9794 03	Simulation on the detection of subsurface cracks by the surface acoustic wave (Invited Paper) [9794-106]
9794 04	Research on the detection technology of amusement facilities (Invited Paper) [9794-112]
9794 05	The intelligent signing system of internet of things about environmental health workers based on RFID (Invited Paper) [9794-114]
9794 06	Study on the noise characteristics of optical fiber transmission loss test system (Invited Paper) [9794-119]
9794 07	Outlier detection based on variance of angle in high dimensional data (Invited Paper) [9794-140]
9794 08	Study on system for extracted type infrared gas analysis (Invited Paper) [9794-150]
9794 09	Background estimation and player detection in badminton video clips using histogram of pixel values along temporal dimension (Invited Paper) [9794-170]
9794 0A	Weak magnetic field measurement by using all-optical potassium atomic spin magnetometer (Invited Paper) [9794-4]
9794 OB	Probability estimation of being detected on simplified model for ship in shallow water (Invited Paper) [9794-65]
9794 OC	Novel active frequency drift with positive feedback method of photovoltaic islanding detection (Invited Paper) [9794-97]
SESSION 2	COMMUNICATIONS AND NETWORKING
9794 OD	A method of integer programming for track fine adjustment (Invited Paper) [9794-100]

9794 OE	MFAHP: A novel method on the performance evaluation of the industrial wireless networked control system (Invited Paper) [9794-109]
9794 OF	Designed a web crawler which oriented network public opinion data acquisition (Invited Paper) [9794-116]
9794 OG	Offshore pollution source localization in water using wireless sensor networks (Invited Paper) [9794-12]
9794 OH	Optimization design of city rail routing [9794-126]
9794 OI	Changeable HA to improve MIPv6 protocol (Invited Paper) [9794-127]
9794 OJ	A novel probabilistic broadcasting strategy for UUV ad hoc networks (Invited Paper) [9794-129]
9794 OK	Residual energy level based clustering routing protocol for wireless sensor networks (Invited Paper) [9794-144]
9794 OL	Obstacle avoidance path planning of cart based on Fourier transform random probability function (Invited Paper) [9794-145]
9794 OM	The wireless sensor network node localization algorithm based on multitudinous beacon (Invited Paper) [9794-154]
9794 ON	Enhancing source location protection in wireless sensor networks (Invited Paper) [9794-161]
9794 00	HNP renumbering support in PMIPv6 (Invited Paper) [9794-163]
9794 OP	An intelligent distributed antenna system for indoor LTE wireless network (Invited Paper) [9794-167]
9794 OQ	A phase-coding framework for SSVEP-based BCI (Invited Paper) [9794-168]
9794 OR	Improvement of node localization algorithms on wireless sensor network (Invited Paper) [9794-37]
9794 OS	A fast selective video encryption algorithm by selecting data randomly (Invited Paper) [9794-42]
9794 OT	A study of internet of things real-time data updating based on WebSocket (Invited Paper) [9794-47]
9794 OU	Research on the coding and decoding technology of the OCDMA system (Invited Paper) [9794-5]
9794 OV	Research on MOMPDES algorithm of block cipher in compressed sensing (Invited Paper) [9794-63]
9794 OW	Research of home energy management system based on technology of PLC and ZigBee (Invited Paper) [9794-78]

9794 OX	Design of remote car anti-theft system based on ZigBee (Invited Paper) [9794-79]
9794 OY	A velocity estimation algorithm for LTE system (Invited Paper) [9794-8]
9794 OZ	Research and design of documents compression algorithm based on variable length encoding (Invited Paper) [9794-81]
9794 10	Modulation instabilities in two-core nonlinear fiber coupler (Invited Paper) [9794-84]
9794 11	A dual-routing strategy on scale-free networks (Invited Paper) [9794-99]
SESSION 3	SIGNAL PROCESSING
9794 12	Multi-scale fractal analysis of modulation signals (Invited Paper) [9794-120]
9794 13	Root cause analysis of oxide scale forming and shedding in high temperature reheater of a <b>200MW</b> super high pressure boiler (Invited Paper) [9794-122]
9794 14	Measurement fusion information filter for multisensor descriptor system with correlated noises [9794-125]
9794 15	Research on ground-moving target type recognition based on local mean decomposition (LMD) and support vector machine (SVM) (Invited Paper) [9794-132]
9794 16	Shortest path algorithm for transit network considering walking between bus stops (Invited Paper) [9794-14]
9794 17	The evaluation research of operational suitability tests of the photoelectric reconnaissance equipment (Invited Paper) [9794-143]
9794 18	Research on surface seismic source location method based on local mean decomposition and time difference of arrival (Invited Paper) [9794-148]
9794 19	Research on high-accuracy time delay of wideband digital signal based on frequency-domain phase weighting method (Invited Paper) [9794-149]
9794 1 A	Design of broadband antenna minimum mismatching network using SRFT (Invited Paper) [9794-153]
9794 1B	An improved S-function LMS algorithm (Invited Paper) [9794-155]
9794 1C	Improve simulation accuracy of grey model by space transformation (Invited Paper) [9794-157]
9794 1D	Modeling method of time sequence model based grey system theory and application proceedings (Invited Paper) [9794-158]
9794 1E	A track fusion method of a vessel (Invited Paper) [9794-164]
9794 1F	A homology sound-based algorithm for speech signal interference (Invited Paper) [9794-165]

9794 1G	Development and application of traffic flow information collecting and analysis system based on multi-type video (Invited Paper) [9794-17]
9794 1H	The collocation model based on LDA (Invited Paper) [9794-25]
9794 11	Tuck scheduling in cross-docking systems: review and modeling considering cargo loading/unloading sequences (Invited Paper) [9794-26]
9794 1J	Design of the standard part library of modular fixture based on Pro/TOOLKIT (Invited Paper) [9794-28]
9794 1L	A fuzzy C-mean cluster based shaking elimination method for video of forest fire prevention (Invited Paper) [9794-54]
9794 1M	Study on the feature extraction and classification of underwater target radiated noise based on bispectrum (Invited Paper) [9794-56]
9794 1N	Simulation of radar target echo based on Simulink (Invited Paper) [9794-57]
9794 10	Application of data fusion technology based on D-S evidence theory in fire detection (Invited Paper) [9794-59]
SESSION 4	IMAGE PROCESSING
9794 1Q	Research on fusion algorithm of polarization image in tetrolet domain (Invited Paper) [9794-108]
9794 1R	Image seam line method based on the combination of dijkstra algorithm and morphology (Invited Paper) [9794-123]
9794 1S	Robust design of dilation and erosion CNN for gray scale image (Invited Paper) [9794-128]
9794 1T	Segmentation of medical ultrasound images using an adaptive magnetostatic bidirectional balloon snake model (Invited Paper) [9794-160]
9794 1U	Research on features matching method for visual odometry based on depth image (Invited Paper) [9794-169]
9794 1V	A region-based fusion rule using K-means clustering for multi-sensor image fusion (Invited Paper) [9794-19]
9794 1W	Automatic LED chips defect inspection using level set method of image segmentation (Invited Paper) [9794-22]
9794 1X	Color enhancement algorithm for low-quality image based on gamma mapping (Invited Paper) [9794-44]
9794 1Y	Self-recovery fragile watermarking algorithm based on SPHIT (Invited Paper) [9794-46]
9794 1Z	Image segmentation based on region merging technique (Invited Paper) [9794-55]

9794 20	Navigation for underwater vehicles using gray-scale histogram (Invited Paper) [9794-61]
9794 21	Medical image visualization based on transfer function design (Invited Paper) [9794-64]
9794 22	Techniques of vision inspection aided by kalman filter in medicine packing production (Invited Paper) [9794-67]
9794 23	Development and application of analytical simulation software platform for parallel beam CT (Invited Paper) $[9794-91]$
SESSION 5	ELECTRONICS TECHNOLOGY
9794 24	The transmission band gap characteristic of one-dimensional voltage-controlled photonic crystals (Invited Paper) [9794-111]
9794 25	Experimental study on the relationship between the seeding rate and seeding performance of the seed metering device (Invited Paper) [9794-117]
9794 26	The analysis of surveying and positioning for L2C code of GPS modernization satellites (Invited Paper) [9794-131]
9794 27	Research of restraining harmonic circulating current in photovoltaic inverter wireless parallel system (Invited Paper) [9794-136]
9794 28	Testability analysis for crosstalk faults in VLSI circuits by using binary decision diagrams (Invited Paper) [9794-20]
9794 29	Performance analysis and model for ultra-tight coupling (Invited Paper) [9794-29]
9794 2A	Experimental study for the effect of the cyclone configuration on the separation performance of the wet-gas recycling supersonic separator (Invited Paper) [9794-30]
9794 2B	Testing and simulation of the conductor rail dynamic system (Invited Paper) [9794-31]
9794 2C	Development and application of information monitoring system for underground engineering construction (Invited Paper) [9794-32]
9794 2D	Technology and application of 3D tunnel information monitoring (Invited Paper) [9794-33]
9794 2E	Simulation on the steel galvanic corrosion and acoustic emission (Invited Paper) [9794-35]
9794 2F	Design of acoustic emission monitoring system based on VC++ (Invited Paper) [9794-36]
9794 2G	Design of portable diagnostic system of cucumber leaf mildew (Invited Paper) [9794-38]
9794 2H	Design of high-accuracy multiple-function dual-path frequency meter (Invited Paper) [9794-77]
9794 21	Electronic structure and optical properties of CaTiO <sub>3</sub> : An ab initio study (Invited Paper) [9794-80]

9794 2J	Data threats analysis and prevention on iOS platform (Invited Paper) [9794-92]
SESSION 6	ARTIFICIAL INTELLIGENCE AND ALGORITHMS
9794 2K	Modular tensor sparsity preserving projection algorithm for dimension reduction (Invited Paper) [9794-101]
9794 2L	Research algorithm and simulate trajectory for the variable-mass line-throwing ball (Invited Paper) [9794-102]
9794 2M	Detection method of vegetable maturity based on neural network and bayesian information fusions (Invited Paper) [9794-103]
9794 2N	The design of P center algorithm based on raster data (Invited Paper) [9794-118]
9794 20	Site selection model for new metro stations based on land use (Invited Paper) [9794-121]
9794 2P	Content and user-based music visual analysis (Invited Paper) [9794-124]
9794 2Q	Cloud-based robot remote control system for smart factory (Invited Paper) [9794-130]
9794 2R	Transit ridership prediction of Changchun light rail line 3 (Invited Paper) [9794-146]
9794 2S	Research on the application of wisdom technology in smart city (Invited Paper) [9794-147]
9794 2T	Spatial and temporal partitioning validation for ARINC635-based avionics software (Invited Paper) [9794-151]
9794 2U	Empirical research in service engineering based on AHP and fuzzy methods (Invited Paper) [9794-152]
9794 2V	The literature review of research on modeling of automated guided vehicle's picking route (Invited Paper) [9794-156]
9794 2W	A structural property of enhanced hypercube (Invited Paper) [9794-162]
9794 2X	Minimized error propagation location method based on error estimation (Invited Paper) [9794-166]
9794 2Y	Algorithm and achieve of self-balancing two-wheeled control system based on PID neural network (Invited Paper) [9794-172]
9794 2Z	The power grid AGC frequency bias coefficient online identification method based on wide area information (Invited Paper) [9794-34]
9794 30	Evaluating the correlation between a factor with an object by principal component analysis (Invited Paper) [9794-41]
9794 31	An aggregate method to calibrate the reference point of cumulative prospect theory-based route choice model for urban transit network (Invited Paper) [9794-43]

9794 32	A simulation model of IT risk on program trading (Invited Paper) [9794-45]
9794 33	Facets grouping electromagnetic occultation algorithm based on mesh size (Invited Paper) [9794-49]
9794 34	Non-local anisotropic total variation based super resolution (Invited Paper) [9794-50]
9794 35	Operational combat-based artillery firing accuracy data analysis (Invited Paper) [9794-53]
9794 36	Design of an audio advertisement dataset [9794-58]
9794 37	Design and implementation of PKI-based certification authority (Invited Paper) [9794-60]
9794 38	Connections between Sylvester resultant matrix and Bezout matrix for Bernstein polynomials basis (Invited Paper) [9794-66]
9794 39	Transfer matrix method for deriving transfer functions of LTI systems (Invited Paper) [9794-68]
9794 3A	XML documents cluster research based on frequent subpatterns (Invited Paper) [9794-70]
9794 3B	Research on the SIM card implementing functions of transport card (Invited Paper) [9794-72]
9794 3C	Research on the java card operand stack based attack and countermeasures (Invited Paper) [9794-76]
97943D	Temperature distribution imaging using ultrasonic CT by maximum-likelihood expectation-maximization algorithm (Invited Paper) [9794-94]
9794 3E	A geographic information system-based 3D city estate modeling and simulation system (Invited Paper) [9794-98]

Proc. of SPIE Vol. 9794 979401-10

### **Authors**

Numbers in the index correspond to the last two digits of the six-digit citation identifier (CID) article numbering system used in Proceedings of SPIE. The first four digits reflect the volume number. Base 36 numbering is employed for the last two digits and indicates the order of articles within the volume. Numbers start with 00, 01, 02, 03, 04, 05, 06, 07, 08, 09, 0A, 0B...0Z, followed by 10-1Z, 20-2Z, etc.

Bai, Qinghai, 37 Bao, Lingling, 2A Bao, Yu, 31 Bian, Hongyu, 20 Bo, Jiang, 13 Cai, Zhishan, 10 Cao, Jie, 0M Cao, Jin, 21 Cao, Lin, 1M Cao, Wenfu, 2U Cen, Minyi, 0D Chang, Faliang, 3D Chang, R. K., 2G Che, Shuwei, OB Chen, Ge, 2D Chen, Hong-Dou, 2M Chen, Hou-jin, 1F Chen, Jing, 37 Chen, Juan, 0N Chen, Ling, 1W, 28 Chen, Musheng, 10 Chen, Rong, 0V

Chen, Shuang-shuang, 12

Chen, Weiyi, 2S
Chen, Xiyuan, 0A
Chen, Xuewu, 2O
Chen, Yanna, 38
Chen, Zhikui, 0K
Chen, Zhou, 2J
Cheng, Kuo, 1G
Chieng, W. H., 39
Chong, Xiaoli, 3E
Chun, Hua, 37
Cui, Hongxia, 22
Cui, Lili, 2T
Cui, Shi-Gang, 2M
Dai, Wei, 0T
Deng, Chi, 2l

Deng, Hongliang, 2C, 2D Deng, Hubin, 0V

Ding, Tienan, 3A Dong, Hui, 0L Dong, Jianhua, 30 Dong, Jun, 12 Dong, Xiao, 1C Dou, Yinfeng, 14 Du, Zhi Jun, 05 Du, Zhijiang, 0L Fan, Longfei, 26 Fan, Qiang, 2l Fang, Hong, 0X Fang, Xiaojie, 1L Feng, Shengfeng, 1R

Fu, Hui, 11 Fu, Min, 16 Fu, Yutao, 36 Gao, Ang, 0M Gao, Bo, 2J

Gao, P., OR

Gao, Chongxiana, 26

Gao, Xinyu, 09
Gao, Ying, 0F
Gao, Ying, 21
Ge, Yuechun, 16
Geng, Guanggang, 0O
Geng, Yuting, 36
Gu, Ruirui, 08
Gu, Weihua, 2S, 2V
Guan, Jinfa, 2B
Guo, Feng, 1U
Guo, Huinan, 1X
Guo, Shuxia, 21
Guo, Xiaochun, 2P
Guo, Yang, 2C, 2D

H., Peilin, 33
Han, Tailin, 02
Hao, Honglian, 19
Hao, Weidong, 13
He, Wei, 2F
He, Xiujun, 10
He, Xuan, 11
He, Zhiqiang, 11
Hei, Dongwei, 23
Hu, Qing-gui, 01
Hu, Ruifeng, 0V
Hu, Xiaotang, 03
Hu, Zhihong, 13

J., Jinzu, 33 Jeng, S. L., 39 Ji, Xinkai, 1G Jia, Hongfei, 2R Jian, Chen, 2H Jiang, B. C., 35 Jiang, Chuanxian, 1Z Jiang, Dezhi, 0E Jiang, Jianrong, 2H Jiang, Qin-bo, 1N

Hua, Mingzhuang, 1G

Jiang, Wenbao, 32 Jiang, Yi-jiao, 1F Jiana, Zhixia, OH, 2R Jin, Zhanxin, OC Kong, Lihong, 2N Kong, Ling-yun, 04 Kuana, Daizhi, 1R Lan, Zhenping, OU Lee, Xiaodong, 0O Li, Bing, 12 Li, Bingging, 3D Li, C. L., 0R Li, Changqing, 2C, 2D Li, He, 25 Li, Hong Lian, 0X Li, Jiancheng, 1R Li, Jie, 2R Li, Jingfeng, 11 Li, Juntao, 2S, 2V Li, Ju-peng, 1F Li, Kaiyan, 15, 18 Li, Lianzhong, 2Q Li, Lin, 0Y Li, Min, 1S Li, Ping, 0U Li, Sha, 3E Li, Shiguang, 2Z Li, Sun, OC Li, Wei, 08 Li, Wei, 3A Li, Wenzhong, 08 Li, Xiongfei, 3A Li, Yangtenglong, 0D Li, Yanning, 03 Li, Yanzhong, 0H Li, Yi, 3B, 3C Li, Yongxing, 2R Li, Zhi, OJ Li, Zhi, 1Z Li, Zhiping, 1Z Li, Zhiyong, OS Li, Zhongsheng, 17 Liang, Bo, OT Liang, Fan, 2M Lin, Bin, 03 Lin, Jiaru, 11 Lin, Zhengkui, 0N Liu, Ai, 05 Liu, Beixuan, OJ Liu, Chengyuan, 26 Liu, Fuguo, 13 Liu, H., OR, 2G Liu, Hongmei, 2W Liu, Jiaqi, 22 Liu, Jihong, 36 Liu, Peng-yuan, 12 Liu, Quan, 0Y Liu, Weibo, 15, 18

Liu, Zhe, 08 Long, Man, 31 Lu, Muiie, 1G Lu, Shan, OF Lue, B. H., 39 Luo, Guangxuan, 32 Luo, Hui, 24 Luo, Jianhui, 23 Luo, Sida, 16, 31 Luo, X., 0G Luo, Yaling, 1D Lv, Dongdong, 2K Lv, Qiang, 1U Ma, Hong-guang, 1N Ma, Hui, OF Ma, Jianye, 1U Ma, Jiming, 23 Ma, Libin, 2C Ma, Shuai, 2S Ma, Xiao, 09 Ma, Ying, 1B Mao, Qingbo, 0C Mei, Chao, 1X Meng, Chunxia, 0B Meng, Pinchao, 0H Min, Lequan, 1S Mu, Hao, OB Mu, Lin, 1M Ni, Hao, 1E Ni, Wei, OP, 2X Nie, Yunju, 1R Niu, Kai, 11 Niu, Yuanyuan, 25 Pan, Zhongliang, 1W, 28 Peng, Yahui, 09 Peng, Yuan, 1M Qi, Mingming, 2K Qiu, Runqing, 2L Ran, Chenjian, 14 Re, Jun, 1N Ren, Qing-fang, 1A S., Changyong, 33 Sha, Xuejun, 1L Shang, Wenjie, 1G Shen, Hanxia, 31 Shen, Jiaojiao, 0W Shen, Mei, 24 Shen, Minfen, 1T Sheng, Liang, 23 Sheng, Zhang, 2H Shi, Weizhao, 1J Shi, Xin, 2E Shi, Xingyi, 2R Shi, Yun, 05 Song, Xiaodong, 1X Song, Zhi, 1A Song, Ziqi, 20 Sun, Jing-xiao, 1N Sun, Kemei, 06 Sun, Pengfei, 1L

Liu, Wenli, 10

Liu, Wenting, 07

Sun, Yan, 1H Tang, G. C., 2G Tang, Jigiang, 2J Tang, Lei, 2P Tang, Tingting, 10 Tian, Jinwen, 34 Wang, Bailing, ON Wang, Fangxiu, OZ Wang, Guangwei, 34 Wang, Guosheng, 1U Wang, Guoyin, 30 Wang, Hao, 16 Wang, Haolin, 30 Wang, Jiang Hua, 2Y Wang, Jianyong, 2T Wang, Jiaxiao, 17 Wang, Jinpeng, 0U Wang, Lijie, 1J Wang, Lin, 3B, 3C Wang, Peng, 2K Wang, Qi, 2Y Wang, Qingwen, 0J Wang, Qunshu, 23 Wang, Ruiqi, 0C Wang, Simiao, 2D Wang, WeiDong, OL Wang, Weiyu, 0C Wang, Xiaoyan, 19 Wang, Xin Ling, 05 Wang, Xingjun, OS Wang, Y. H., 2G Wang, Y., 2G Wang, Yi, 2J Wang, Ying, 2T Wang, Yingzhi, 02 Wang, Yuru, 0U Wang, Zeng-sheng, 04 Wang, Zhaoxin, OC Wang, Zian, 2Z Wei, Fuli, 23 Wei, Qi, 0W Wei, Shoulin, OT Wei, Xuexia, 1D Wei, Y., OR Wei, Yaxu, 03 Wen, Jiangtao, 15, 18 Wen, Qiang, 08 Wu, Di, 0N Wu, Huazhang, 38 Wu, Hui, 2V Wu, Jianhua, 2L Wu, Lingin, 0E Wu, Pingdong, 0Q Wu, Shenglin, 2C, 2D Wu, Siging, 1E Wu, Xijun, 18 Wu, Xing-Li, 2M Wu, Zhiming, 2Q

Xia, Bingying, 32

Xia, Jingtao, 23

Xiao, Fei, 34 Xie, Xiao-zhu, 1V Xin, Li Pina, 1Y Xu, Dekai, 1J Xu, Han, 29 Xu, Hongyu, 06 Xu, Jinglei, 03 Xu, Mingchen, 25 Xu, Sheng, 0E Xu, Wuxiong, 1E Xu, Yang, 1B Xu, Yang, 2Q Xu, Ya-wei, 1V Xue, Yan-bing, 1A Yan, GangFeng, 0X Yan, Huyong, 30 Yan, Qiming, 1R Yan, Zhiwei, 00 Yang, Deli, 0K Yang, Han-song, 04 Yang, Hongwei, 2T Yang, J., 0G Yang, Jianhui, 21 Yang, Lifeng, 24 Yang, Li-Li, 2M Yang, Panpan, 27 Yang, Ping, 2E Yang, Qiuling, 0Q Yang, Wenming, 0S Yang, Yungao, OP Yao, Jun, 08 Ye, Yan, 11 Yin, Renping, 0J Yin, Weishi, 0H Yu, Jie, 0Z Yu, Konglin, OT Yu, Ting, 2Z Yu, Xiaojing, 15, 18 Yu, Yang, 2E, 2F Yu, Yongchang, 25 Yuan, BaoHong, 1Q Yuan, Dan, 2W Yuan, Xu, 0K Zeng, Dazhi, 19 Zhai, Jingmei, 2Q Zhang, Derui, 1X Zhang, Dexiang, 1Q Zhang, Fengzhen, 1M Zhang, Gaopeng, 1X Zhang, Guo-hui, 0M Zhang, Hong, 0A Zhang, J. G., 35 Zhang, Jianping, 21 Zhang, Jingjing, 1Q Zhana, Kaifei, 25 Zhang, Lina, 2U Zhang, Mohan, 2K Zhang, Nan, 16, 20 Zhang, Qi, 36

Zhang, Qiong, 1T

Zhang, Shaohua, 08

Zhang, Shiqiang, 1C, 1D

Zhang, Wen-ge, 0M

Zhang, Xiaoli, OT

Zhang, Xiaoliang, 1S

Zhang, Yanrui, 2U

Zhang, Yufeng, 31 Zhang, Zejun, 1Z

Zhang, Zhan-song, 1F

Zhang, Zhaohui, 1M

Zhang, Zhigang, 20

Zhang, Zhijun, 1B

Zhao, Feng, 1L

Zhao, Jinge, 15

Zhao, Linna, 37

Zhao, Peng, 0C

Zhao, Xin, 2L

Zhao, Yan, 2Y

Zhao, Z. Q., 35

Zhao, Zijian, 3D

Zheng, Boling, 1T

Zheng, Longjiang, 15

Zheng, Ying, 37

Zhong, Dong, 1E

Zhong, Fangming, OK

Zhong, Yuan, 2B

Zhou, Fangxu, 09

Zhou, Jie, 0V

Zhou, Mingduan, 26

Zhou, Shijun, 21

Zhu, Longji, 27

Zhu, Yi-sheng, 1A

Zielinski, Adam, 20

Zou, Nianyu, 0U

Zou, Sheng, 0A

xiv

## **Conference Committee**

#### Conference Chairs

Wenbo Wang, Dalian University (China)

#### Committee Title

**Qiang Zhang**, Dalian University (China) **Shuqin Lou**, Beijing Jiaotong University (China) **Chunling Yang**, Harbin Institute of Technology (China)

#### Program Committee

**Houjin Chen**, Beijing Jiaotong University (China) **Zhiming Liu**, Beijing Jiaotong University (China)

**Fuzhen Xuan**, East China University of Science and Technology (China)

Hui Tian, Beijing University of Posts and Telecommunications (China)

Piotr Boniecki, Poznan University of Life Sciences (Poland)

Wooi-Nee Tan, Multimedia University (Malaysia)

**Denghua Li**, Beijing Information Science and Technology University (China)

Hongyuang Yang, Beihang University (China)

Chi-Cheng Cheng, National Sun Yat-Sen University (Taiwan)

Yanan Yao, Beijing Jiaotong University (China)

**Zheng You**, Tsinghua University (China)

Krzysztof Koszela, Poznan University of Life Sciences (Poland)

**Huachun Zhou**, Beijing Jiaotong University (China)

Li Wang, University of Science Technology Beijing (China)

**Zhifeng Liu**, Hefei University of Technology (China)

Jianfeng Li, Shandong University (China)

Yongsheng Zhao, Yanshan University (China)

Fushuan Wen, South China University of Technology (China)

**Zhaojun Yang**, Jilin University (China)

Hongchao Zhang, Texas Tech University (United States)

**Ping Xu**, Shenzhen University (China)

**Huibin Qin**, Hangzhou Dianzi University (China)

**Dean Zhao**, Jiangsu University (China)

**Jeng-Shyang Pan**, National Kaohsiung University of Applied Sciences (Taiwan)

**Ru Ding**, Shenyana Ligona University (China)

Guangtao Ma, Shenyang Jianzhu University (China)

Limin Ma, Dalian Polytechnic University (China)

Chundong Ma, Dalian Nationalities University (China)

Lisha Ma, Dalian Ocean University (China)

Hong Wang, Liaoning Metallurgy Technician College (China)

**Ziru Wang**, Dalian University of Technology (China)

**Danhong Wang**, Dalian University of Technology (China)

**Guoshun Wang**, Dalian Jiaotong University (China)

Jianwei Wang, Dalian University (China)

Xianghai Wang, Liaoning Normal University (China)

Yuehui Wang, Dalian Maritime University (China)

Xin Mao, Northeastern University (China)

Yiyuan Fang, Laoning institute of Science and Technology (China)

**Zilong Deng**, Liaoning Shihua University (China)

Jialian Shi, University of Science and Technology Liaoning (China)

Wei Cong, Shenyang Aerospace University (China)

Fengyan Zhu, Bohai Shipbuilding Vocational College (China)

Wenhua Liu, Dalian Polytechnic University (China)

Qingke Liu, Liaoning Technical University (China)

**Pingyang Xiao**, Northeastern University (China)

Hongxia Song, Dalian University of Technology (China)

Yutang Zou, Dalian Maritime University (China)

Qiang Zhang, Dalian University (China)

**Zhenggui Zhang**, Shenyang University (China)

**Shuping Chen**, Northeastern University (China)

Chunjiang Lin, Dalian Ocean University (China)

**Jiaxin Zhou**, Shenyana Jianzhu University (China)

**Yinghua Xiang**, University of Science and Technology Liaoning (China)

**Jiquan Yao**, Liaoning Technical University (China)

Qingni Hu, Dalian University of Technology (China)

**Shen Zhao**, Dalian University (China)

Qi He, Liaoning University of Technology (China)

**Libo Tang**, Dalian Jiaotong University (China)

Ran Qin, Shenyang University of Chemical Technology (China)

**Shiyan Huang**, Dalian University (China)

Ying Huang, Northeastern University (China)

Xiaomin Lan, Liaoning Shihua University (China)

Huibiao Lu, Dalian Maritime University (China)

Surong Pan, Shenyang University (China)

Dong Feng, Tianjin University (China)

Tzu-Fu Chiu, Aletheia University (Taiwan)

Yuan Xiaojie, Nankai University (China)

Jun Gao, Shandona University (China)

Wenxian Yu, Shanghai Jiaotong University (China)

**Shide Xiao**, Southwest Jiaotong University (China)

Chengshan Wang, Tianjin University (China)

Mingzhou Liu, Hefei University of Technology (China)

Minping Jia, Southeast University (China)

**Duoqian Miao**, Tongji University (China)

Feng Dong, Tianjin University (China)

Yuehua Tan, Wuhan University of Technology (China)

Jiuhua Xu, Nanjing University of Aeronautics and Astronautics (China)

Xiaoyun Chen, Lanzhou University (China)

**Shiming Ji**, Zhejiang University of Technology (China)

Xianmin Zhang, South China University of Technology (China)

Jiqing Han, Harbin Institute of Technology (China)

Xu Han, Hunan University (China)

**Xiaofei Yang**, Huazhong University of Science and Technology (China)

**Dunwen Zuo**, Nanjing University of Aeronautics and Astronautics (China)

**Tieli Sun**, Northeast Normal University (China)

**Shihong Shi**, Soochow University (China)

Yougang Yang, Northwest A&F University (China)

Aixin Fena. Jianasu University (China)

**Shuguang Gong**, Xiangtan University (China)

**Chin-Shiuh Shieh**, National Kaohsiung University of Applied Sciences (Taiwan)

**Zhengxin Hou**, Tianjin University (China)

Yuxian Gai, Harbin Institute of Technology (China)

**Tieliang Lu**, Shandong University (China)

**Lizhong Xu**, Yanshan University (China)

Lijun Cao, Shandong University (China)

Li Wang, Shandong University (China)

**Zhihong Yang**, Shandong University (China)

Jiang Han, Hefei University of Technology (China)

Yongcun Guo, Anhui University of Science and Technology (China)

Jianwei Liu, Beijing University of Aeronautics and Astronautics (China)

Mingyan Jiang, Shandong University (China)

Youxiang Duan, University of Petroleum (China)

**Yuanlong Chen**, Hefei University of Technology (China)

**Huabing Zhu**, Hefei University of Technology (China)

Tian Huang, Tianjin University (China)

Proc. of SPIE Vol. 9794 979401-18

### Introduction

The Sixth International Conference on Electronics and Information Engineering (ICEIE 2015) was held on 26-27 September 2015 in Dalian, China.

The aim of ICEIE 2015 is to present the latest research of scientists (professors, students, PhD Students, engineers, and post-doctoral scientists) related to Electronics and Information Engineering topics. This conference provides opportunities for delegates of different areas to exchange new ideas and application experiences face-to-face. ICEIE also aids in the establishment of business or research relationships and global partnerships for future collaboration.

After the peer-review process, submitted papers were selected on the basis of originality, significance, and clarity. The selected papers and additional late-breaking contributions presented as lectures made for an exciting technical program. The conference was extremely rich and featured high-impact presentations. We hope that the conference resulted in a significant contribution to the corresponding scientific fields.

The proceedings record presents the refereed papers presented at the conference. Hopefully, all participants and other interested readers will benefit scientifically from the proceedings and will also find them stimulating in the process.

All organizing members are committed to continued improvement of ICEIE's professionalism, academic research, and discussion platforms. We look forward to your consistent attention to and support of the Seventh International Conference in Electronics and Information Engineering in 2016.

**Qiang Zhang** 

Proc. of SPIE Vol. 9794 979401-20