

# CHUANG SHI

Date of birth: October 13th, 1986

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- My research interests span the areas of adaptive signal processing, array signal processing, and nonlinear signal processing.
- Currently, I have a specific interest in applying signal processing techniques in ultrasonics, nonlinear acoustics and noise control.
- I have published 9 SCI indexed and 20 EI indexed papers.
- I am looking for a faculty position to teach and to pursue research in signal processing and its applications in human auditory sensation.

## EDUCATION

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### **Nanyang Technological University, Singapore**

August 2008 - May 2013

- Ph. D. in Electrical and Electronic Engineering
- Thesis: Investigation of the steerable parametric loudspeaker based on phased array techniques  
*My Ph. D. thesis develops phased array techniques to control the directivity of the parametric sound source, and addresses the practical problems such as spatial aliasing and discrepancy between theory and measurement.*

### **Tsinghua University, Beijing, China**

September 2005 - July 2008

- M. S. in Instrument Science and Technology
- Thesis: Research on MEMS sensor of fluid measurement

### **Beijing Jiaotong University, Beijing, China**

September 2001 - July 2005

- B. S. in Computer Science and Technology
- Final year project: Development of intelligent palm system of rehabilitation training

## ACADEMIC AWARDS

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- Excellent Student Paper Award from the 2016 IEICE International Workshop on Smart Info-Media Systems in Asia (SISA), 2016.
- Excellent Student Paper Award from the 2014 IEICE International Workshop on Smart Info-Media Systems in Asia (SISA), 2014.
- Best Young Poster Presenter Award from the 21st International Congress on Acoustics (ICA), 2013.
- IEEE Signal Processing Society Travel Grant from the 38th IEEE International Conference on Acoustics, Speech, and Signal Processing (ICASSP), 2013.
- Dragon Venture Scholarship, Nanyang Technological University, 2011.
- Research Scholarship, Nanyang Technological University, 2008-2011.
- Beijing Outstanding Graduate, 2005.
- First Prize in Contemporary Undergraduate Mathematical Contest in Modeling, 2003 and 2004.
- First Prize in Mathematical Contest in Electrical Engineering Modeling, 2003.

## RESEARCH EXPERIENCE

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**Research Fellow**

April 2016 - Present

*Nanyang Technological University, Singapore*

- Employed under land and livability national innovation challenge (L2 NIC) grant, "Abating traffic noise through a holistic approach of noise monitoring, analytics and control"

**Postdoctoral Fellow**

April 2014 – March 2016

*Kansai University, Osaka, Japan*

- Employed under MEXT-supported program for the strategic research foundation at private university, "Ultra-large-scale data processing and communications for computer holography technology".

**Postdoctoral Researcher**

December 2013 - March 2014

*University of Electro-Communications, Tokyo, Japan*

**Research Fellow**

June 2013 - November 2013

*Nanyang Technological University, Singapore*

- Employed under ministry of education (MOE) tier-2 grant, "Next-generation 3D sound system for 3D TV: Theory, experiments, and applications".

**Research Associate**

June 2011 - May 2013

*Nanyang Technological University, Singapore*

- Employed under national research foundation (NRF) interactive digital media (IDM) R&D grant, "Next-generation directional sound beam with bass enhancement and beamsteering to support new IDM applications".

## FUNDING

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**Co-Principal Investigator**

December 2012 - November 2013

*Funding Agency: National Environment Agency, Singapore*

250,000 SGD

- Project: Noisy vehicular surveillance camera system

**Co-Principal Investigator**

January 2013 - December 2013

*Funding Agency: Mitsui Sumitomo Insurance Welfare Foundation*

10,000 SGD

- Project: Improving auditory experiences for hearing impaired listeners using unique combination of conventional and parametric loudspeakers
- US provisional patent: Improving hearing impairment using audio beam system

## TEACHING EXPERIENCE

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**Co-supervisor of Master Course Students at Kansai University (with Prof. Kajikawa)**

- Mr. Shoma Edamoto, "Virtual sensing technique in feedforward active noise control", 2016-2018.
- Mr. Ryosuke Imamoto, "Applying parametric array loudspeakers in 3D sound reproduction", 2015- 2017.
- Mr. Yuta Hatano, "Linearization of the 2nd- and 3rd-order nonlinearity of the parametric array loudspeaker", 2014-2016. [Excellent student paper award winner]
- Mr. Hiroaki Bessho, "Numerical study of parametric array loudspeaker using the Texas code", 2014-2016.
- Mr. Kihiro Tanaka, "Applying parametric array loudspeakers in active noise control to reduce the factory noise", 2013-2015.

**Advisor of Final Year Project at Nanyang Technological University**

- Ms. Yan-Xin Koo, "Idling car detection using Arduino", 2013-2014.
- Mr. Kaung Myat Thu, "Vehicle type classification using low-cost web cameras", 2013-2014.
- Ms. Hui-Shan Tan, "Vehicle type classification using audio analysis methods", 2013-2014.

- Mr. Md Mehedi Hasan, "Investigation of noise features of different types of vehicles", 2012-2013.
- Mr. Jia-Jin Tan, "Vehicle classification using an array of low-cost web cameras", 2012-2013.
- Mr. Kwok-Ming Yew, "Graphic user interface of a next generation directional sound beam audio system with beam steering to support new interactive digital media applications", 2010-2011.

## PUBLICATIONS

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### Peer-reviewed Journals

1. C. Shi and Y. Kajikawa, "Volterra model of the parametric array loudspeaker operating with ultrasonic frequencies," under minor revision, *Journal of the Acoustical Society of America*, 2016.
2. K. Tanaka, C. Shi and Y. Kajikawa, "Binaural active noise control system using parametric array loudspeakers," *Applied Acoustics*, vol. 116, pp. 170-176, 2017.
3. C. Shi and Y. Kajikawa, "Effect of the ultrasonic emitter on the distortion performance of the parametric array loudspeaker," *Applied Acoustics*, vol. 112, pp. 108-115, 2016.
4. C. Shi, Y. Kajikawa, and W. S. Gan, "Generating dual beams from a single steerable parametric loudspeaker," *Applied Acoustics*, vol. 99, pp. 43-50, 2015.
5. C. Shi and Y. Kajikawa, "A convolution model for computing the far-field directivity of a parametric loudspeaker array," *Journal of the Acoustical Society of America*, vol. 137, no. 2, pp. 777-784, 2015.
6. C. Shi, Y. Kajikawa, and W. S. Gan, "An overview of directivity control methods of the parametric array loudspeaker," *APSIPA Transactions on Signal and Information Processing*, vol. 3, no. E20, pp. 1-12, 2014.
7. C. Shi, H. Nomura, T. Kamakura, and W. S. Gan, "Spatial aliasing effects in a steerable parametric loudspeaker for stereophonic sound reproduction," *IEICE Transactions on Fundamentals of Electronics, Communications and Computer Science*, vol. E97-A, no. 9, pp.1859-1866, 2014.
8. C. Shi and W. S. Gan, "Steerable parametric loudspeaker with preprocessing methods," *Proceedings of Meetings on Acoustics*, vol. 19, no. 055027, pp. 1-6, 2013.
9. C. Shi, E. L. Tan, and W. S. Gan, "Hybrid immersive three-dimensional sound reproduction system with steerable parametric loudspeakers," *Proceedings of Meetings on Acoustics*, vol. 19, no. 055003, pp. 1-6, 2013.
10. C. Shi and W. S. Gan, "Analysis and calibration of system errors in steerable parametric loudspeakers," *Applied Acoustics*, vol. 73, no. 12, pp. 1263-1270, 2012.
11. C. Shi and W. S. Gan, "Product directivity models for parametric loudspeakers," *Journal of the Acoustical Society of America*, vol. 131, no. 3, pp. 1938-1945, 2012.
12. C. Shi and W. S. Gan, "Grating lobe elimination in steerable parametric loudspeaker," *IEEE Transactions on Ultrasonics, Ferroelectrics, and Frequency Control*, vol. 58, no. 2, pp. 437-450, 2011.
13. C. Shi and W. S. Gan, "Development of a parametric loudspeaker: A novel directional sound generation technology," *IEEE Potentials*, vol. 29, no. 6, pp. 20-24, 2010.

### Under review

14. Y. Hatano, C. Shi and Y. Kajikawa, "Towards a practical design of the inverse system for the parametric array loudspeaker," submitted to *IEEE/ACM Transactions on Audio Speech and Language Processing*, 2016.

### Selected Conferences

1. C. Shi, D. Shi, T. Murao, B. Lam, and W. S. Gan, "Understanding multiple-input multiple-output active noise control from a perspective of sampling and reconstruction," submitted to *the 42nd IEEE International Conference on Acoustics, Speech and Signal Processing (ICASSP)*, New Orleans, Louisiana, March 2017.
2. D. Shi, C. Shi, and W. S. Gan, "A systolic FxLMS structure for implementation of feedforward active noise control on FPGA," in *Proceedings of the 2016 APSIPA Annual Summit and Conference*, Jeju, Korea,

December 2016.

3. C. Shi, T. Murao, D. Shi, B. Lam, and W. S. Gan, "Open loop active control of noise through open windows," in *Proceedings of the 5th joint meeting of the Acoustical Society of America and the Acoustical Society of Japan*, Honolulu, Hawaii, November 2016.
4. S. Edamoto, C. Shi, and Y. Kajikawa, "Virtual sensing technique for feedforward active noise control," in *Proceedings of the 5th joint meeting of the Acoustical Society of America and the Acoustical Society of Japan*, Honolulu, Hawaii, November 2016.
5. S. Edamoto, C. Shi, and Y. Kajikawa, "Directional feedforward ANC system with virtual sensing technique," in *Proceedings of the 2016 IEICE International Workshop on Smart Info-Media Systems in Asia (SISA)*, Ayutthaya, Thailand, September 2016.
6. C. Shi and Y. Kajikawa, "Synthesis of Volterra filters for the parametric array loudspeaker," in *Proceedings of the 41st IEEE International Conference on Acoustics, Speech and Signal Processing (ICASSP)*, Shanghai, China, March 2016.
7. C. Shi and Y. Kajikawa, "Automatic gain control for parametric array loudspeakers," in *Proceedings of the 41st IEEE International Conference on Acoustics, Speech and Signal Processing (ICASSP)*, Shanghai, China, March 2016.
8. Y. Hatano, C. Shi, S. Kinoshita, and Y. Kajikawa, "Linearization of the parametric array loudspeaker upon varying input amplitudes," in *Proceedings of the 2015 APSIPA Annual Summit and Conference*, Hong Kong, China, December 2015.
9. C. Shi and Y. Kajikawa, "Fast evaluation of preprocessing methods of the parametric array loudspeaker," in *Proceedings of the 2015 Western Pacific Acoustic Conference (WESPAC)*, Singapore, December 2015.
10. Y. Hatano, C. Shi, S. Kinoshita, and Y. Kajikawa, "A study on compensating for the distortion of the parametric array loudspeaker with changing nonlinearity," in *Proceedings of the 2015 Western Pacific Acoustic Conference (WESPAC)*, Singapore, December 2015.
11. Y. Hatano, C. Shi, S. Kinoshita, and Y. Kajikawa, "A linearization system for parametric array loudspeakers using the parallel cascade Volterra filter," in *Proceedings of the 2015 European Signal Processing Conference (EUSIPCO)*, Nice, France, August 2015.
12. C. Shi and Y. Kajikawa, "Ultrasound-to-ultrasound Volterra filter identification of the parametric array loudspeaker," in *Proceedings of the 20th IEEE International Conference on Digital Signal Processing (DSP)*, Singapore, July 2015.
13. C. Shi and Y. Kajikawa, "Identification of the parametric array loudspeaker with a Volterra filter using the sparse NLMS algorithm," in *Proceedings of the 40th IEEE International Conference on Acoustics, Speech and Signal Processing (ICASSP)*, Brisbane, Australia, April 2015.
14. C. Shi and Y. Kajikawa, "Evaluation of modified amplitude modulation methods in the parametric array loudspeaker," *IEICE Technical Report*, vol. 114, no. 474, pp. 67-70, March 2015.
15. C. Shi and Y. Kajikawa, "A comparative study of preprocessing methods in the parametric loudspeaker," in *Proceedings of the 2014 APSIPA Annual Summit and Conference*, Siem Reap, Cambodia, December 2014.
16. C. Shi, H. Nomura, T. Kamakura, and W. S. Gan, "Development of a steerable stereophonic parametric loudspeaker," in *Proceedings of the 2014 APSIPA Annual Summit and Conference*, Siem Reap, Cambodia, December 2014.
17. K. Tanaka, C. Shi, and Y. Kajikawa, "Multi-channel active noise control using parametric array loudspeakers," in *Proceedings of the 2014 APSIPA Annual Summit and Conference*, Siem Reap, Cambodia, December 2014.
18. Y. Hatano, C. Shi, and Y. Kajikawa, "A study on linearization of nonlinear distortions in parametric array loudspeakers," in *Proceedings of the 2014 IEICE International Workshop on Smart Info-Media Systems in Asia (SISA)*, Ho Chi Minh City, Vietnam, October 2014.

19. K. Tanaka, C. Shi, and Y. Kajikawa, "Study on active noise control system using parametric array loudspeakers," in *Proceedings of the 7th Forum Acusticum*, Krakow, Poland, September 2014.
20. B. Lam, W. S. Gan, and C. Shi, "Feasibility of a length-limited parametric source for active noise control applications," in *Proceedings of the 21st International Congress on Sound and Vibration (ICSV)*, Beijing, China, July 2014.
21. C. Shi, H. Nomura, T. Kamakura, and W. S. Gan, "An envelope method for improving the product directivity models of the parametric loudspeaker," *IEICE Technical Report*, vol. 113, no. 412, pp. 53-56, January 2014.
22. C. Shi and W. S. Gan, "A preprocessing method to increase high frequency response of a parametric loudspeaker," in *Proceedings of the 2013 APSIPA Annual Summit and Conference*, Kaohsiung, Taiwan, October 2013.
23. C. Shi, W. S. Gan, Y. K. Chong, A. Apoorv, and K. S. Song, "A vehicular noise surveillance system integrated with vehicle type classification," in *Proceedings of the 2013 APSIPA Annual Summit and Conference*, Kaohsiung, Taiwan, October 2013.
24. C. Shi and W. S. Gan, "Using length-limited parametric source in active noise control applications," in *Proceedings of the 20th International Congress on Sound and Vibration (ICSV)*, Bangkok, Thailand, July 2013.
25. C. Shi, H. Mu, and W. S. Gan, "A psychoacoustical preprocessing technique for virtual bass enhancement of the parametric loudspeaker," in *Proceedings of the 38th IEEE International Conference on Acoustics, Speech and Signal Processing (ICASSP)*, Vancouver, Canada, May 2013.
26. C. Shi and W. S. Gan, "Modeling the directivity of parametric loudspeaker," in *Proceedings of the 19th International Symposium on Nonlinear Acoustics (ISNA)*, Tokyo, Japan, May 2012.
27. C. Shi, W. S. Gan, and Y. K. Chong, "Calibration of parametric acoustic array," in the *Proceedings of the 8th International Conference on Information, Communications, and Signal Processing (ICICIS)*, Singapore, December 2011.
28. C. Shi and W. S. Gan, "On grating lobe elimination of difference frequency in parametric loudspeaker," in *Proceedings of the 2010 APSIPA Annual Summit and Conference*, Singapore, December 2010.

## INVITED TALKS

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1. "History and advances in beam pattern control of parametric array loudspeakers", Organization for Research and Development of Innovative Science and Technology, Osaka, Japan, June 2014.
2. "An introduction to parametric array loudspeaker and its application in active noise control", Chung Yuan Christian University, Taiwan, June 2014.
3. "Applying array signal processing in parametric loudspeaker", University of Electro-Communications, Tokyo, Japan, May 2012.

## PROFESSIONAL ACTIVITY

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| <b>Membership</b> | <ul style="list-style-type: none"> <li>• Institute of Electrical and Electronics Engineers (IEEE)</li> <li>• Acoustical Society of America (ASA)</li> <li>• Institute of Electronics, Information and Communication Engineers (IEICE)</li> <li>• Asia Pacific Signal and Information Processing Association (APSIPA)</li> </ul>   |
| <b>Service</b>    | <ul style="list-style-type: none"> <li>• Publicity Co-Chair of APSIPA 2017 Annual Summit and Conference</li> <li>• Candidate of APSIPA Speech, Language, Audio (SLA) Technical Committee</li> <li>• Session Chair at the 5th Joint Meeting of ASA and ASJ, Honolulu, Hawaii, 2017</li> <li>• Special Session Organizer at APSIPA 2014 Annual Summit and Conference</li> <li>• APSIPA Social Net Committee Member, 2013 to present</li> <li>• Reviewer of several SCI indexed journals and EI indexed conferences</li> </ul> |

## REFEREES

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Professor  
Stephen Elliott  
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- Institute of Sound and Vibration Research
- University of Southampton, UK
- *Fellow of the Royal Academy of Engineering*
- *Fellow of the Acoustical Society of America*
- *Fellow of the Institute of Engineering and Technology*
- *IEEE Senior Member*

Associate Professor  
Woon-Seng Gan  
*ewsgan@ntu.edu.sg*

- School of Electrical and Electronic Engineering
- Nanyang Technological University, Singapore
- *Fellow of the Audio Engineering Society*
- *Fellow of the Institute of Engineering and Technology*
- *IEEE Senior Member*

Professor  
Yoshinobu Kajikawa  
*kaji@kansai-u.ac.jp*

- Department of Electrical and Electronic Engineering
- Kansai University, Osaka, Japan
- *IEEE Senior Member*
- *IEICE Senior Member*

Emeritus Professor  
Tomoo Kamakura  
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- Center for Industrial and Governmental Relations
- University of Electro-Communications, Tokyo, Japan
- *Chair of the 19th International Symposium on Nonlinear Acoustics*