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Ph.D. in **acoustics**, focusing on **virtual sound-field reproduction, sound-field auralization, and digital hearing health**. Committed to recreating arbitrary environmental sound fields through digital information and machine learning algorithm technologies. Possesses extensive **interdisciplinary** (acoustics, electronic information, architecture, audiology) research and practical experience. Skilled in various acoustic signal processing, audio processing, measurement techniques, and acoustic experiment design; familiar with acoustic design and simulation, machine learning, digital signal processing chipset development, and circuit design; holds a strong theoretical foundation and engineering implementation capability.

Virtual sound-field reproduction is a key technology for realizing auditory VR, however, obtainging immersvie vitual environment requires unacceptable numerics and hardware cost. Research1 models and measures the physical sound field, then reconstruct a spatialized virtual sound field using digital signal processing and machine learning algorithms via headphones or multichannel loudspeakers. This technology underpins immersive auditory experiences and is widely applied in interior acoustic design, traffic noise environment simulation, aerospace, and hearing health. The research further integrates human-factor studies from digital hearing to design targeted experiments validating perception in VR for both normal-hearing and hearing-impaired groups, forming a complete research loop of “technology development - experimental validation - iterative optimization.”

## Education

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| 2020 - 2025 | **South China University of Technology** · School of Architecture · Building Technology Science<br>Ph.D. candidate \| Supervisor: Prof. Yuezhe Zhao<br>Ph.D. thesis: “On the optimization and perception evaluation of higherorder Ambisonics based auralization reproduction system” |
| 2024 - 2025 | **Technical University of Munich** · Department of Computation, Information and Technology · Audio Information Processing<br>Joint Ph.D. student \| Co-supervisor: Prof. Bernhard U. Seeber |
| 2018 - 2020 | **South China University of Technology** · School of Physics and Optoelectronic Engineering · Acoustics<br>Master’s student \| Supervisor: Prof. Yigang Lu; Co-supervisor: Prof. Guangzheng Yu |
| 2014 - 2018 | **Guangdong University of Technology** · School of Physics and Optoelectronic Engineering · Electronic Science and Technology<br>Bachelor of Engineering |

## Publications

Journal Articles

1. **(SCI Q1 first author) Guo, Z.**, Yu, G., Zhou, H., Wang, X., Lu, Y., and Meng, Q. (2021). "Utilizing True Wireless Stereo Earbuds in Automated Pure-Tone Audiometry," Trends Hear, 25, 23312165211057367. doi:10.1177/23312165211057367
2. **(SCI Q1 first author) Guo, Z.**, Zhao, Y., Wang, L., Chu, Y., and Yu, G. (2023). "Distance discrimination thresholds of proximal sound sources in a real anechoic environment," Applied Acoustics, 203, 109223. doi:10.1016/j.apacoust.2023.109223
3. **(SCI Q2 first author) Guo, Z.**, Lu, Y., Zhou, H., Li, Z., Fan, Y., and Yu, G. (2021). "Anthropometric-based clustering of pinnae and its application in personalizing HRTFs," International Journal of Industrial Ergonomics, 81, 103076. doi:10.1016/j.ergon.2020.103076
4. **(SCI Q1 co-first author)** Shi, X., **Guo, Z.**, and Zhao, Y. (2024). "Influence of virtual audio system on psychological restoration effects of soundscapes: Investigating water sounds of a Chinese classical garden," Applied Acoustics, 221, 109991. doi:10.1016/j.apacoust.2024.109991
5. **(SCI Q2 co-corresponding author)** Zhou, H., Zhou, H., **Guo, Z.**, and Meng, Q. (2024). "Automated Pure-Tone Audiometry Using True Wireless Stereo Earbuds with Active Noise Control," International Journal of Audiology
6. **(Chinese core, EI indexed, co-first author, accepted)** Ao, J., **Guo, Z.**, Wang, J., Sang, J., Wang, X. (2024). "Near-field distance discrimination thresholds for bone-conducted virtual sound sources," Acta Acustica
7. **(SCI Q2)** Zhou, H., Kan, A., Yu, G., **Guo, Z.**, Zheng, N., and Meng, Q. (2022). "Pitch Perception With the Temporal Limits Encoder for Cochlear Implants," IEEE Transactions on Neural Systems and Rehabilitation Engineering, 30, 2528-2539. doi:10.1109/TNSRE.2022.3203079
8. **(to be submitted)** Guo, Z., Seeber, B. U., and Zhao, Y. (2025). "Evaluation of the performance of a multi-layer Ambisonics reproduction method"
9. **(to be submitted)** Guo, Z., and Zhao, Y. (2025). "On the influence of reproduction order and range of elevation under virtual room environment"

Conference Papers

1. 2022 The 24th International Congress on Acoustics: **Guo, Z.**, Zhou, H., & Zhao, Y. (2022). Evaluating speech intelligibility degradation under different orders of Ambisonics. 24th International Congress on Acoustics, Gyeongju
2. 2020 The 179th Meeting of the ASA: **Guo, Z.**, Wang, X., Zhou, H., Lu, Y., Yu, G., & Meng, Q. (2020). Automated pure tone audiometry with true wireless stereo earbuds. The Journal of the Acoustical Society of America, 148(4), 2714-2714
3. 2019 EAA Spatial Audio Signal Processing Symposium **Guo, Z.**, Lu, Y., Wang, L., & Yu, G. (2019). Discrimination experiment of sound distance perception for a real source in near-field. 85-89.
4. (Outstanding conference paper award) 2019 19th Management Ergonomics of the Chinese Society of Ergonomics: Anthropometric parameters-based pinnae clustering and its application in customization of individualized HRTF

Patents

1. **(Invention patent; First inventor; Pending)** A 3D sound reproduction method for layered loudspeaker arrays (一种面向分层扬声器阵列的三维空间声重放方法) Application No: 2025112312337)

## Awards

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| China Scholarship Council | Visiting Program Scholarship | 2023 |
| South China University of Technology | President's Scholarship | 2023 |
| 2nd National Soundscape Design Competition | Third Prize, First Author | 2023 |
| South China University of Technology | President's Scholarship | 2022 |
| Acoustical Society of America | Student Conference Grant | 2022 |
| South China University of Technology | Longhu Corporate Scholarship | 2021 |

## Research projects

**Virual sound-field reproduction system** 2021 – 2025

Using a Array-based higher-order Ambisonics spatial reproduction combined with geometric acoustic simulation to achieve virtual reconstruction of indoor sound fields, enabling listeners to experience arbitrary virtual reality (VR) acoustic environment. The work investigates listeners' perceptual characteristics in virtual sound fields and improves reproduction algorithms for practical deployment.

- Established a higher-order Ambisonics spatial auralization system with 192 speaker channels, implementing full spatial capture and reconstruction of the sound field. This system is currently the largest speaker-based sound field auralization system in the country.
- Proposed an improved algorithm for practical deployment based on physical-field reconstruction and psychoacoustic perception. Compared with traditional methods, this algorithm reduces the number of required speakers while improving the spatial resolution of the reproduction system.
- Investigated listeners' perceptual characteristics in virtual sound fields, including the effects of reproduction errors on speech perception (speech reception threshold, SRT) in virtual environments and the influence of reflection elevation information on listeners' sense of space.

**Binaural Spatial Reproduction Research** 2018 - 2020

Personalized HRTFs are a crucial data foundation for reliable binaural spatial reproduction. To enable customized acquisition of personalized HRTFs while controlling dataset size, research used machine learning based algorithms to group the large HRTF dataset and match participants' pinnae shape with the database.

- Implemented a HRTF-based binaural spatial reproduction system, computing HRTFs using Boundary Element Method (BEM) simulations.
- Designed an HRTF personalization algorithm that matches anthropometric features with clustering techniques for individualized HRTF selection.

**Hearing Health Research** 2019 - 2025

To develop convenient and low-cost hearing assessment and compensation solutions, hence achieve large scale hearing health screening and tracking, research focused on developing an automated pure-tone audiometry using consumer earphones and mobile platforms, a hearing-aid compression compensation algorithms was also built according the measured levels.

- Developed an automated pure-tone audiometry system based on wireless earphones and mobile platforms that supports unattended threshold measurement, electro-acoustic calibration and compensation of earphones, and noise suppression using active noise control; evaluated system performance and error characteristics.
- Implemented a prototype wide dynamic range compression algorithm for hearing aids and tuned its parameters using results from the automated audiometry system to achieve individualized fitting.

**Auditory Distance Perception and Reproduction** 2018 - 2020

A fully immersive VR acoustic experience requires both directional and distance perception of sound sources. Research investigated the perceptual characteristics of near-field auditory distance perception and developed a platform for measuring binaural spatial auditory resolution of distance under near-field conditions.

- Investigated auditory cues that influence distance perception, with emphasis on factors affecting near-field distance perception in virtual reproduction systems.
- Developed a platform for moving-source tests to measure binaural spatial auditory resolution of distance under near-field conditions.

**Virtual Soundscape Reproduction** 2023 - 2024

- Captured outdoor soundscapes and implemented spatial reproduction to create audiovisual virtual environments; investigated how different reproduction algorithms affect perceived psychological restoration and compared virtual and in-situ perception to assess ecological validity.
- Conducted field surveys of classical garden soundscapes and designed virtual garden soundscapes using a higher-order Ambisonics auralization system for immersive audiovisual reproduction.

## Teaching and Others

Technical University of Munich — Teaching Assistant — 2024
Topics in Audio Information Processing Research

University of Oldenburg — Summer School — 2024
Machine Learning & Numerics for Acoustics

South China University of Technology — Teaching Assistant — 2021
Undergraduate Course: Building Physics

South China University of Technology — Teaching Assistant — 2019
Graduate Course: Acoustic Signal Processing

South China University of Technology — Teaching Assistant — 2019
Undergraduate Course: Electronic Practice