Department of Systems Engineering

香港城市大學
City University of Hong Kong

Computational Sensing with Mechanical Metamaterials: Theory and Technology

With the continuous enrichment and development of computing resources, the computational sensing technology combining physical field information coding and sensing algorithm breaks through the limitations of traditional sensing methods and reduces the cost of sensing and data acquisition. Metamaterials can encode the physical field information flexibly and play an important role in computational sensing technology. They have the outstanding advantages of high resolution, lightweight structure, flexible customization and low cost. Aiming at the difficulty that the traditional vibration and acoustics identification methods rely on complex hardware systems such as sensor array and network, this speech introduces mechanical metamaterials-based computational sensing technology for identifying the vibration and acoustic sources. The spatial vibration and acoustic transmission coding metamaterials have been designed. By combining the designed metamaterials with the computational sensing theory, spatial multi-source localization and trajectory tracking have been realized for the vibration and acoustics driven applications. The research results break through the limitation that current vibration and noise identification technology depend on a large number of sensors, and provide a new idea for accurate and efficient vibration and noise identification under the condition of high integration and lightweight. It has important theoretical and application value in the fields of high-end equipment manufacturing and operational maintenance, intelligent human-computer interaction, Internet of things and so on.

8 August, 2025 (Fri)

10:00AM

YEUNG-P7303

Speaker

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Qingbo He is a Professor with the School of Mechanical Engineering, Shanghai Jiao Tong University, China. He received his B.E. and Ph.D. degrees in Mechanical Engineering from the University of Science and Technology of China (USTC). He has worked in Chinese University of Hong Kong, University of Connecticut, and the USTC. He has visited University of Wisconsin–Madison and City University of Hong Kong. His research interests include a combination of vibration analysis, signal processing, and smart structures for intelligent sensing, diagnosis, and maintenance of complex machines. He has published more than 160 peer-reviewed journal papers, including Nature Communications, Matter, and IEEE Transactions. He has been selected in the list of Chinese Most Cited Researchers by Elsevier since 2020. He is a recipient of multiple honors and awards, including National High-Level Leading Talent and National Young Professionals in China, Shanghai Outstanding Academic Leaders, the Best Paper Award from several international conferences. He is an Associate Editor of Frontiers in Physics. He is an IEEE Senior Member and serves as Chair of Nanjing/Shanghai/Wuhan Joint Section Chapter of IEEE Instrumentation and Measurement Society.

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Seminar 2024-2025, SYE30