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X Waves and High-Frame-Rate Fourier-Based Ultrasonic Imaging



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Abstract: X Waves are propagation-invariant solutions to the wave equations that govern the waves in both isotropic/homogeneous media and vacuum. These waves can be either sound or electromagnetic waves. They can be localized in both space and time. The group and phase velocities of the waves are the same and, in theory, larger than the speed of sound in the media or the speed of light in vacuum. In additions, X waves are orthogonal and complete bases that can be used to synthesize any physically realizable waves. Based on the properties of the X waves, a high-frame-rate imaging and Fourier-based method was developed for medical ultrasonic imaging.

In this talk, the X waves, and the Fourier-based high-frame-rate imaging method and its applications in medical ultrasonic imaging will be introduced.

Biography: Dr. Jian-yu Lu received the B.S. degree in electrical engineering in February 1982 from Fudan University, Shanghai, China; the M.S. degree in acoustics in 1985 from Tongji University, Shanghai, China; and the Ph.D. degree in biomedical engineering in 1988 from Southeast University, Nanjing, China. From December 1988 to February 1990, he was a Postdoctoral Research Fellow at Mayo Medical School, Rochester, Minnesota, USA.

Since 1997, Dr. Lu has been a full professor in the Department of Bioengineering at The University of Toledo (UT), Toledo, OH, USA, and since 1998, he has been an adjunct professor in the College of Medicine. He served as a graduate director of the Department of Bioengineering at UT from 1999 to 2002.

Before joining UT as a professor in 1997, he was an associate professor of biophysics at the Mayo Medical School and an associate consultant at the Department of Physiology and Biophysics, Mayo Clinic/Foundation, Rochester, MN, USA.

His research interests are in acoustic imaging and tissue identification, medical ultrasonic transducers, and ultrasonic beam forming and propagation. Dr. Lu has been granted five United States patents in which he is the sole or principal inventor. Dr. Lu is a Fellow of IEEE, a Fellow of the American Institute of Ultrasound in Medicine (AIUM), and a Fellow of the American Institute for Medical and Biological Engineering (AIMBE).