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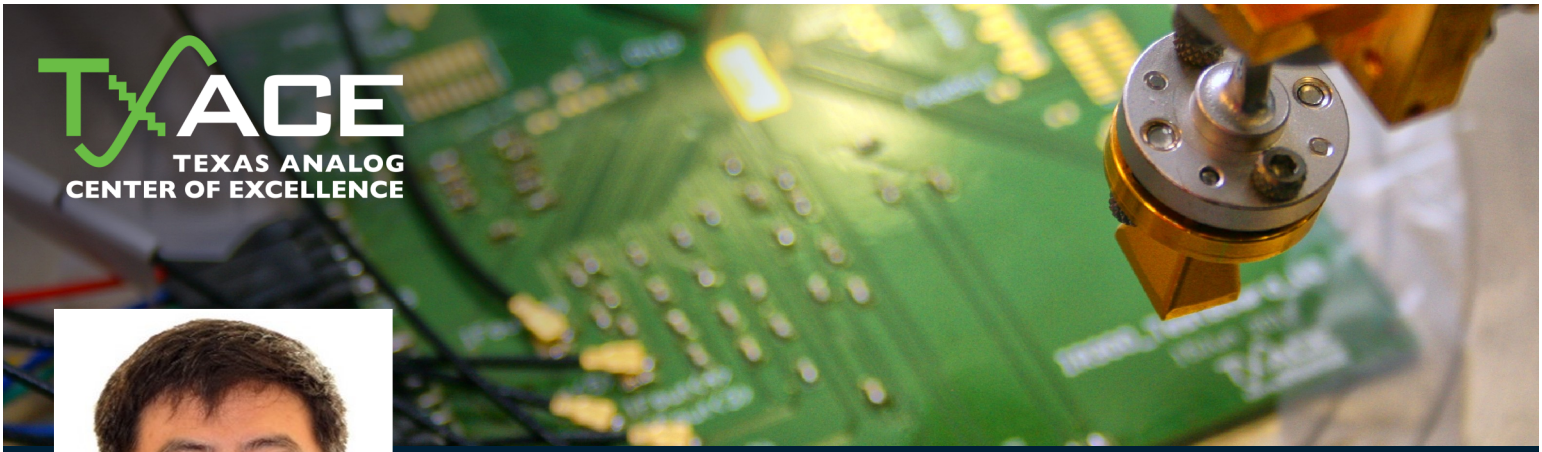

Millimeter Wave Packaging Research—Antenna in Package

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BIO

Dr. Hongbing Lu is a professor and Louis A. Beecherl Jr. chair of Mechanical Engineering at University of Texas at Dallas. He received his PhD in Aeronautics from Caltech, MS in Engineering Mechanics at Tsinghua University, and BS in Solid Mechanics at Huazhong University of Science and Technology. He specializes in the experimental mechanics of time-dependent materials, including aerogels, polymers, and composites. He has developed experimental techniques to characterize the viscoelastic behavior of materials such as composites and mold compounds using nanoindentation, and digital image correlation. He is a fellow of ASME (American Society of Mechanical Engineers) and SEM (Society for Experimental Mechanics). He is the editor-in-chief for Mechanics of Time-Dependent Materials, and an associate technical editor for Experimental Mechanics

ABSTRACT

Antenna-in-Package (AiP) is in increased demand as a packaging solution for high performance wireless systems. With industrial focus on miniaturization, operating frequencies have pushed to millimeter waves (mmWaves), to make them suitable for 5G and beyond applications. This poses challenges on the front-end modules (FEM) to deliver innovative packaging solutions which can fulfill the FEM integration requirements to maximize the performance. To realize it as a complete solution, high frequency and high temperature material dielectric behavior is characterized to meet the design specifications considering automotive grade reliability standards. Similarly, mechanical characterization of the package/system is also utilized to ensure reliability to comply with the Automotive Qualification Standard (AECQ100).

The talk will discuss AiP solutions from a multi-disciplinary SRC project (Task 2810.056) co-led by Rashaunda Henderson (electrical engineering), Mark Lee (physics) and Hongbing Lu (mechanical engineering) from UT Dallas. At first, two innovative packages, namely flip-chip enhanced QFN (FCeQFN) and embedded die enhanced QFN (EDeQFN) are introduced for mmWave antenna integration in WR8 (90GHz-140GHz) and WR5 (140GHz-220GHz) frequency bands, respectively. The project goals will be presented along with measurement methodologies to characterize the AiP. Next, the broadband dielectric property characterization technique for optimal eQFN material selection will be presented. A workflow to characterize fatigue failure under board level vibration will be introduced. Simulation results indicating the potential locations of the solder failure under vibration will also be presented. Validation of simulation results is conducted using fringe projection to directly measure the vibration mode when a printed circuit board (PCB) is under vibration.

Friday, November 18, 2022 at 1:00 – 2:00 p.m.
Osborne Conference Room (ECSS 3.503)

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