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M.S. SEMINAR TALK

Title: **Paradigm shift in PAUT: Redefining the Ultrasound Imaging Using Custom Phased Array Excitation**

Speaker: **Mr. Thacker Setu Rameshbhai (ME23S027)**

Biography of the Speaker:

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Date and time: **11-02-2026 at 4:00 PM**

Venue: https://meet.google.com/vaw-jsjy-nxu

Abstract

The conventional Phased Array Ultrasound Testing (PAUT) technique employs a series of piezoelectric transducers to facilitate beamforming and enhance imaging capabilities. A more recent methodology, which incorporates Full Matrix Capture/Total Focusing Method (FMC/TFM), further advances this technique through synthetic focusing for image reconstruction. In this research, we present a novel hybrid approach known as eVASA, which integrates active focusing and steering by leveraging the concept of a virtual source within the material during PAUT. eVASA stands for eccentric Virtual Aperture Source Array, offers key advantages, including: (a) the capability to transmit waves at a specified angle while simultaneously focusing at a designated depth from the contact surface, (b) a reduction in inspection time, (c) the ability to perform inspections without the use of a wedge to provide beam directivity up to a certain angle, and (d) an improved signal-to-noise ratio (SNR) in the imaging of defects located far from the leading edge of the transducer. The eVASA technique employs a customized excitation or firing sequence, in which elements within the active aperture transmit ultrasonic waves according to pre-calculated delay laws. This procedure achieves beamforming directed towards virtual sources positioned beneath the transducer at user-defined depths and angles. The excited waves constructively interfere at the virtual source and subsequently propagate toward the region of interest (RoI). As a result, a highly energized wave front travels through the material in a specific direction after converging at a virtual source location. Once required excitations have been executed to cover the intended inspection area within the material, synthetic focusing algorithms, known as Total Focusing Method (TFM), can be applied to reconstruct the 2D image. Parameters such as the depth and angle of the virtual sources, as well as the number of elements in the active aperture of the probe, are defined by the user. A comparative analysis of eVASA and FMC demonstrates a substantial improvement in SNR, even when the transducer is positioned at a considerable distance from RoI. Moreover, eVASA can be implemented using standard PAUT probes and instruments. The primary challenge lies in determining the optimal locations of the virtual sources within the material to achieve an enhanced signal-to-noise ratio. This study aims to demonstrate the beamforming capability achieved through the utilization of virtual sources.