

DESIGN AND PERFORMANCE OF A 5-CM SPHERICALLY FOCUSED AIR-COUPLED ULTRASONIC TRANSDUCER

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This paper reports the development, testing, and performance evaluation of a new spherically focused capacitive air-coupled ultrasonic transducer 5 cm in diameter. A flexible micro-machined copper/polyimide backplate permits a conformal fit to a spherically shaped fixture, forming the rear capacitor plate. A spherically deformed 6- m aluminized Mylar foil forms the front capacitor plate, completing the transducer. The device's frequency spectrum is centered near 800 kHz with -6dB points at about 400 and 1200 kHz. The device's focal-plane behavior is successfully modeled theoretically as a focused piston radiator. The imaging and defect detection capabilities of the new transducer are demonstrated in a series of critical tests; a 250- μm wire is easily imaged in a confocal geometry with a second device. Composite, honeycomb, and wood samples are imaged in through-transmission C-scans, showing internal defects. A printed circuit board is imaged, showing features as small as 200- μm .

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