MEMS Ultrasonic & Magnetic Sensors
Professor David A. Horsley

Piezoelectric Micromachined Ultrasound Transducers

Researchers: Stefon Shelton, Ofer Rozen, and Yipeng Lu

<table>
<thead>
<tr>
<th>Air-Coupled 200 kHz Applications</th>
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<tbody>
<tr>
<td>• Ranging</td>
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<tr>
<td>• 3D imaging</td>
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<tr>
<td>• Gesture recognition</td>
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pMUT Design and Fabrication

Transducer cross section
37 element array
Fabrication Process Flow

Reduced Mass Design
Wideband Frequency Response
Vented Design

Reduced Stress Sensitivity

Improved Acoustic Coupling

Piezo-Acoustic FEM
Acoustic Resonator Gain
Acoustic Resonator Gain Bandwidth

Lorentz Force Magnetic Sensors
Researchers: Mo Li and Vashwar Rouf

Single-structure 3-axis Magnetic Sensor

Closed-loop Magnetic Sensor

Sensor Characterization

Freq. Response & Sensitivity
Earth’s Field Measurement

Parameter
3-axis Sensor
Closed-loop
<table>
<thead>
<tr>
<th>Field (Hz)</th>
<th>Gain (mV/μT)</th>
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<tr>
<td>X-field</td>
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Sensor Characterization

Spectrum & Sensitivity
Scale Factor over Temperature
DC Field Measurement

Implements Lorentz force sensor based on oscillator
Eliminates the need for external oscillator
Improves stability over temperature change

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