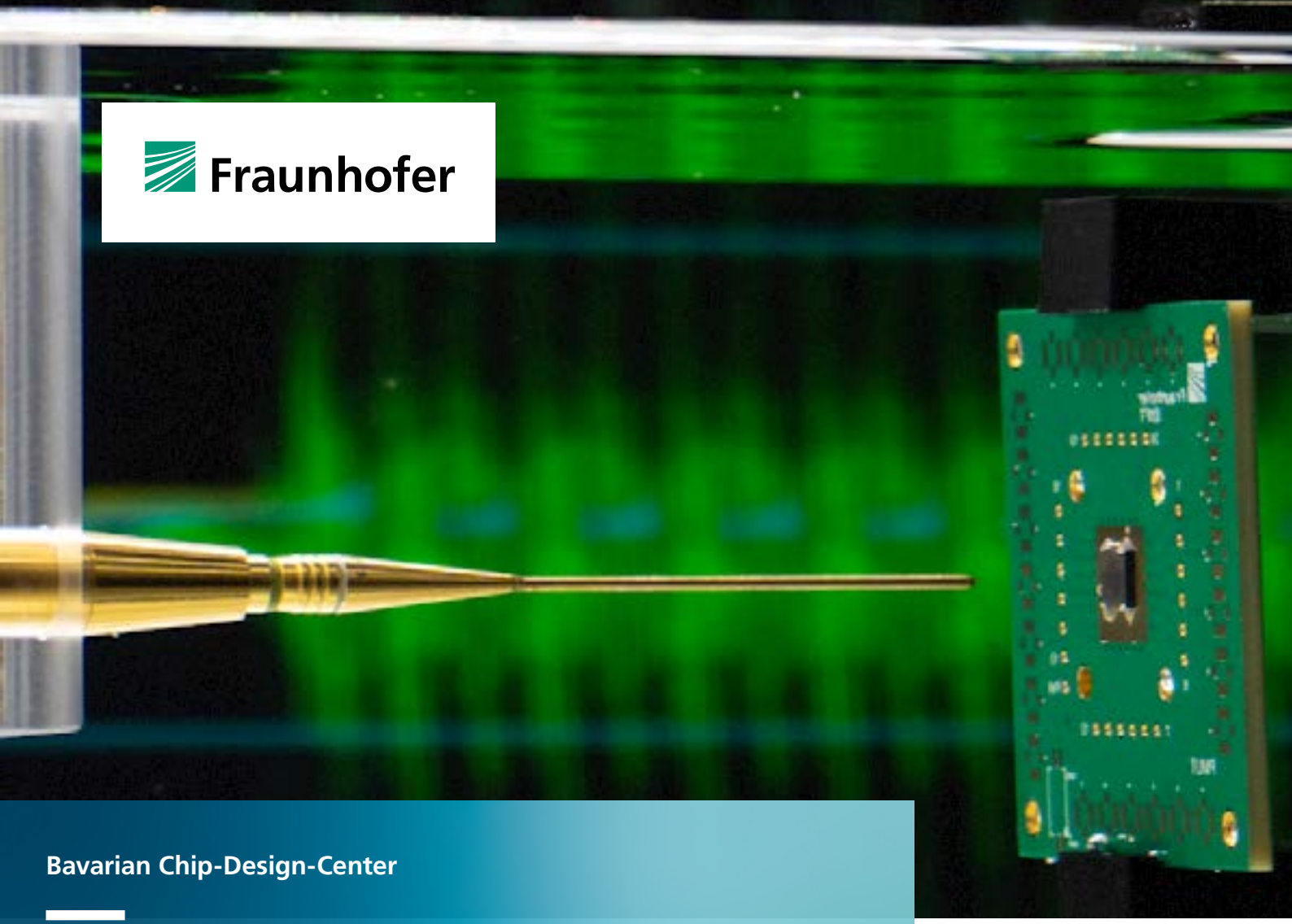


Fraunhofer

Bavarian Chip-Design-Center

Technology Offering for Characterization of Ultrasonic MEMS Transducers

Measurement environment for the characterization of MEMS ultrasonic transducers. ©Fraunhofer EMFT / Puneet Sansare

Motivation

Ultrasonic MEMS Transducers leverage ultrasonic waves for precise sensing and actuation in different fields, such as medical imaging, environmental monitoring, gesture recognition or distance measurement. Characterization of ultrasonic MEMS transducers is a crucial task in their development process, required e.g. for quality assurance, performance evaluation and failure analysis. It enables design optimization and helps to ensure that the transducers meet the performance requirements and are suitable for their intended applications.

The Fraunhofer EMFT Ultrasonic Lab in Munich offers all manufacturers of ultrasonic MEMS transducers the opportunity to test and characterize their products with professional equipment, by competent circuit design experts of the research institute.

Technology Offering

The Fraunhofer EMFT ultrasonic lab is equipped with technical infrastructure and facilities for carrying out characterization and measurements of ultrasonic systems with operation frequency of 0.1-20 MHz and operation distance under 50 cm in fluidic environments.

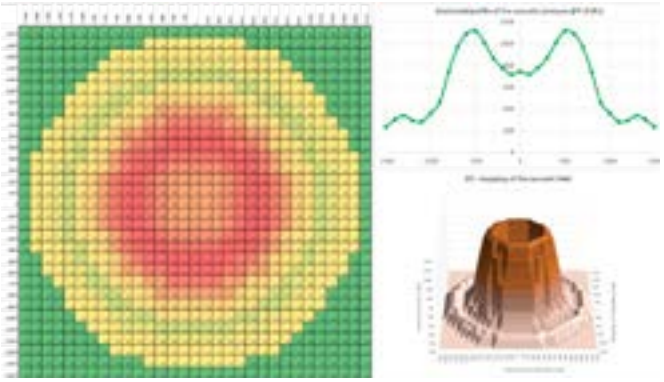
The measurements in the Fraunhofer EMFT ultrasonic lab include:

- Measurement of the acoustic field in XYZ (3D mapping) generated by the actuator: Actuator acting as a transmitter
- Measurement of various phase shifts of multichannel actuators
  - In water / silicone oil: Hydrophone (0.1 - 20 MHz)
  - In air: Microphone (0.05 - 2 MHz)
- Measurement of the reception power / sensitivity of the acoustic field, generated by the reference transducer: Actuator acting as a receiver
- Destructive test: maximum acoustic field and voltage prior to destruction
- Impedance measurement with VNA and determination of the equivalent electric model of the actuators

The system can be characterized in air, in a non-conductive silicone oil or in deionized water. In the latter, the ultrasonic MEMS transducer needs to be hermetically encapsulated prior to the characterization, which can also be supported at our facilities. Measurements of systems with operation frequency over 50 kHz are possible. Prior to the characterization, information on the operation voltage, maximum expected acoustic field, as well as the operation medium (water, oil, air) of the system is required. Moreover, the ultrasonic MEMS transducers need to be mounted on a suitable printed circuit board (PCB), which can be provided upon request or supported at our facilities.

The cost and duration of the characterization depends on the type of the actuator (especially the bondage and sealing of the system) and the type of measurements to be carried out. The average duration is one day per sample. Measurements of impedance and acoustic field can be carried out parallel on several systems.

The measurement results are delivered in form of a characterization report in an encrypted form. Measurement summary as an application file for visual presentation of the acoustic field during measurement is also possible.

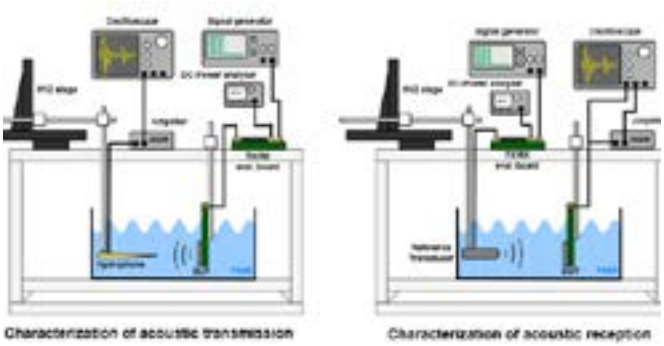


2D acoustic field scan of a multichannel PMUT

Technical Data

The following equipment is available in the Fraunhofer EMFT ultrasonic lab:

- Hydrophone for measurements in silicone oil (0.1 – 20 MHz)
- Hydrophone for measurements in water (0.1 – 20 MHz)
- Reference transducer (0.1 – 20 MHz)
- Ultrasonic microphone (0.1 – 20 MHz)
- Signal amplifier (20 dB)
- DC power analyzer (up to 60V)
- 8-Channel Transmit-/Receive Board for Signal generation / reception
- Oscilloscope
- Vector Network Analyzer (900 Hz – 67G Hz)



Setup for acoustic field measurements of ultrasonic transducers in fluids

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