



Contribution ID: 20

Type: Oral

## Latest developments in ultrasound transducer technology and future directions

*Thursday, November 2, 2017 1:20 PM (40 minutes)*

### Abstract

Standard clinical diagnostic ultrasound systems are making cross-sectional (2D planes) views with a linear array transducer consisting of about 100-200 elements. For advanced diagnosis real-time three-dimensional imaging with adequate spatial and high temporal resolution is needed. Three major directions are currently under development: Firstly, the ultrasound systems having matrix array transducers with 10,000+ elements together with embedded electronics (Application Specific Integrated Circuits (ASICs)). Secondly, high frame rate imaging with (volume) frame rates of 100 –2000 frames per second. Thirdly, the processing of the huge amount of data as received by the individual elements for generating (parametric) images in real-time.

The research focusses on medical acoustical imaging of the heart, liver, kidney, brain, breast and other organs. It includes new ways of measuring the perfusion of the myocardium, developing new accurate three dimensional imaging methods and therapeutic applications. The research lines are the bubble physics for (molecular) imaging and drug delivery, development of matrix transducers with integrated electronics for three dimensional imaging (e.g. catheter based three dimensional ultrasound imaging) and imaging methods like superharmonic imaging and shear wave imaging. It also includes flow patterns determination in the left ventricle and development of ultrasound methods for stiffness determination of the septal wall of the left ventricle for heart failure patients, construction of very small ultrasound transducers with integrated electronics for use in small children and baby's and devices for 3D imaging of the carotid artery for vulnerable plaque determination.

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**Session Classification:** Session 7: Ultrasound transducer