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Institut für Elektrotechnik, Elektronik und Informationstechnik

Optimization of Ultrasound Transducers for Ultrasound Computer Tomography

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Diskussionsleitung: Prof. Dr.-Ing. R. Lerch

We are developing a new imaging method for breast cancer diagnosis: ultrasound computer tomography (USCT). USCT allows recording of reproducible 3D images with high spatial resolution and tissue contrast. Additionally, quantitative measurements of physical parameters, i.e. speed of sound and attenuation, which are known to be altered by cancer, are possible.

For USCT over thousand small unfocused transducers are used for emitting and receiving, in contrast to the phased array technique usually employed in US imaging. The focusing is done off line by a synthetic aperture focusing technique (SAFT). The main advantage of this methodology is the increased image quality, as the resulting image is optimally focused everywhere. The disadvantage of this approach is low signal to noise ratio of the recorded signals due to the small active area of the transducers.

One of the main challenges of USCT is therefore the optimization of dedicated ultrasound transducers. The currently applied transducer array systems are in house products, designed to deliver an acceptable signal to noise ratio, in addition to showing high reproducibility and being low cost. The individual piezo elements are square and micro-structured in grid shape using a waver saw. In order to allow an higher degree of freedom in optimization of the transducers, we started to work with IMF-III (Institute for Material Sciences III, also FZK) on plastic molding processes for the piezo transducers. This process will allow us nearly arbitrary shapes of the transducers and their micro-structuring.

In this talk will shortly introduce the idea of USCT and the current status of the device as a 3D demonstration system. Then, in more detail the currently used ultrasound transducer arrays and the newly developed molding process will be described. Finally possible optimized shapes of the piezo transducers and the possible advantages of simulation will be discussed.