ACOUSTICS2008/1190
Photoacoustic imaging and laser-ultrasonics using Fourier domain reconstruction methods

Peter Burgholzer[a], Thomas Berer[a], Bernhard Reitinger[a], Robert Nuster[b] and Günther Paltauf[b]
[a]Upper Austrian Research, Hafenstr. 47, 4020 Linz, Austria
[b]Karl-Franzens-Universität Graz, Universitätsplatz 5, 8010 Graz, Austria

Laser-ultrasonics as well as photoacoustic imaging use optically generated acoustic waves detected at the sample surface to image its interior. In laser-ultrasonics a laser pulse is absorbed at the sample surface generating an ultrasound pulse that propagates into the sample, is subsequently reflected at internal structures, and finally detected at the surface by an interferometer. In photoacoustic imaging ultrasound is generated by heating of light-absorbing structures inside of an optical semitransparent sample. The goal in photoacoustic imaging is to recover the spatial distribution of the absorbed energy density inside the sample from the acoustic pressure signals measured outside the sample (photoacoustic inverse problem).
Fourier reconstruction is based on the decomposition into plane waves and is a fast and efficient method used in photoacoustic imaging. Interpolation is needed when signal Fourier components are mapped to source Fourier components. We have shown that the synthetic aperture focusing technique (SAFT) in frequency domain, which needs no interpolation, and the Fourier reconstruction method are mathematically equivalent if the step size of the spatial discretization goes to zero. Both imaging methods are compared using simulated data and measurement data acquired with our interferometer set-up.
This work has been supported by the Austrian Science Fund (FWF), project P18172-N02 and project L418-N20.