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Point spread function of the limited-view array transducers in optoacoustic tomography: numerical and experimental studies

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Optoacoustic (OA) tomography utilizes pulsed laser radiation for thermoelastic excitation of wideband ultrasonic pulses. The distribution of laser-induced heat release can be reconstructed if the ultrasonic pulses are detected by an array of transducers. The resolution provided by an array depends on various aspects of its design - the number of elements, element size, spacing and arrangement - and is determined by the point spread function (PSF) of the array. In present work PSFs of arrays with different characteristics are calculated using the Rayleigh integral for simulating the direct problem, and backprojection algorithm for solving the inverse problem of OA tomography. Universal dependencies of the resolution provided by an array on the dimensions and arrangement of its elements are found. Numerical studies are validated by experimental measurements of PSFs of different arrays.