AbstractID: 8254 Title: Simulation of Ultrasound Two-dimensional array transducers using a Frequency domain model

Purpose: Ultrasound imaging with two-dimensional (2D) arrays has garnered broad interest from scanner manufacturers and researchers for real time three-dimensional (3D) imaging. Previously we described a frequency domain B-mode imaging model applicable for linear and phased array transducers. In this study, we extend this model to incorporate 2D array transducers. **Method and Materials:** The pressure field for a 64×64 square array with element dimension of 0.15 mm and center-to-center spacing of 0.2 mm was calculated by applying the paraxial approximation to solve the 2D Rayleigh integral. We assume a rigid baffle, no apodization, a 2.5 MHz center frequency, and a speed of sound of 1540 m/s. A single transmit focus at 30 mm and dynamic receive focus with an F-number of 2 was utilized. The 2D array model is compared with the widely used ultrasound simulation program FIELD II, which utilizes an approximate form of the time domain impulse response function. **Results:** Discrepancies between waveforms computed using our model and FIELD II are less than 4%, regardless of the steering angle for distances greater than 2 cm, yet computation times are on the order of 1/35 of those using FIELD II. Modern beam-forming techniques such as apodization, dynamic aperture, dynamic receive focusing and 3D beam steering can also be simulated. The simulated beam patterns and point spread function images allow evaluation of beam properties for specific transducer parameters. Simulations of B-mode images provide vivid demonstrations of the ability of 2D arrays with specific imaging parameters to detect lesions of a given backscatter contrast and size. **Conclusion:** The frequency domain approach provides an effective and feasible tool to model transmitted and pulse-echo fields as well as B-mode images for 2D array transducers.