Ultrasonics 2017
Demo exercise 1

Deadlines: Acoustic levitator 30.3. at 12:15.
Phased array 2.4. 23:59.

Acoustic levitator

1. a) Explain the basic principle of acoustic levitation.
b) Say you want to build a (simple) levitator with two traps. At what distance should the reflector be from the transducer? (f=35 kHz, in air)

2. Find a publication about acoustic levitation and summarize the key points.

Ultrasound phased array imaging demo - Synthetic aperture focusing exercise

a) Unzip SAFT_exercise.zip into your computer hard drive. Open Plot_phased_array_b_scan_image__v2.m in Matlab and run it to plot a B-scan image. This B-scan image represents a single element pulse-echo measurement in water by scanning over 128 elements of a phased array transducer. Locate two steel cylinders in water (location at scan axis and depth axis). Using the formula for a transducer near field (natural focus), calculate the minimum number of transducer elements (transducer aperture minimum size) needed to focus to the depth of each cylinder in the image. The transducer element size is 0.75 mm, pitch is 1 mm and center frequency is 2 MHz. Sound velocity in water is 1500 m/s. Why does the wave front scattered from the cylinders look curved?

b) Open Plot_phased_array_focused_b_scan_image.m. The code calculates focusing starting from the first a-line in the data from part a) (first a-line of focused dataset) using the aperture defined in the variable "aperture_size_pxls". Update the code to calculate focusing for the rest of the data by adding a for-loop to perform calculations starting from a-line 2, 3, 4, etc. Set the focal depth (variable "depth_mm") to the depth of the cylinders one at a time and observe how the image changes. Remember to use a wide enough aperture size calculated in part a). What is the lateral size of the cylinders in the images and how does the focusing depth affect this size?