

Exercise 2 - Use of ultrasound scanner

The purpose of this exercise is to briefly familiarize with practical ultrasound scanning and common artefacts in the ultrasound image. This exercise is accompanied with a session in the ultrasound laboratory, where you can experiment with ultrasound scanners, learn the effects of different imaging settings, and see imaging artefacts that may appear in ultrasound. If you are doing this exercise without attending the session, try to answer the questions based on ultrasound theory.

Problem 1. Images of the body. Use a Vscan to produce images of the heart and the carotid artery, situated in the neck.

- Try imaging with and without gel on the probe. What is the difference? Why do we put gel on the probe?
- What are the advantages and disadvantages of ultrasound compared to other imaging techniques (e.g. X-ray, CT, MRI)?
- What probe is preferred for a) heart imaging and b) carotid imaging. Why?
- What is the function of the LED on the probe?

If you have time, try activating Doppler mode using the button on the lower left, and try to find areas with blood flow.

Problem 2. Obstacles, reverberations and mirroring. Use a phased array (cardiac) probe to produce an image of objects and water bubbles in the aquarium. Ensure that the probe is not submerged in water above the marker. Cover the transducer aperture by a sponge, both partially and completely. What happens? Now cover the aperture with a wooden plate, partially and completely, such that the plate touches the aperture surface.

- Which anatomical obstacles are emulated by the sponge and the wooden plate?
- Explain in words what effects these obstacles have on the ultrasound image.
- Can you explain why the impacts of the sponge and the wooden plate are different.

Position the wooden plate at some distance below the probe, such that the surface of the reflector is parallel to the probe surface.

- What do you see? Can you explain why?

- Tilt the plate such that the angle between the surface and the plate is approximately 45 degrees. Try to touch the plate with your finger such that the finger shows up on the ultrasound image. What do you see? Can you explain?

Problem 3. Stationary phantom. Consider the image of the stationary phantom.

- Adjust the tgc sliders? What happens? Leave the tgc sliders such that all scatterers have about the same intensity.
- Increase the imaging depth and gain until you can see thermal (flickering) noise in the image. Is the thermal noise stronger far away from or close to the probe? Why?
- Describe what happens when you change the frequency? Specifically, what happens to resolution and signal intensity versus depth?
- What happens when you change the focus depth?