

## Biomedical Imaging FS 2020

### Ultrasound 3

Please prepare solutions in pdf format and upload them on the Moodle platform (<https://moodle-app2.let.ethz.ch/>).

#### Exercise

1. Consider pulsed Doppler velocity measurement with the following specifications:

ultrasound frequency:  $f = 3.2 \text{ MHz}$

density of the medium:  $\rho = 1.0 \frac{\text{g}}{\text{cm}^3}$

impedance of the medium:  $Z = 1.6 \cdot 10^6 \frac{\text{kg}}{\text{m}^2\text{s}}$

- a. What is the range of Doppler shifts that can be resolved unambiguously at a pulse repetition frequency of 1 kHz?
  - b. What is the corresponding range of velocities for motion along the direction of the ultrasound beam?
  - c. How is spatial selectivity achieved in Doppler velocity measurements?
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2. Speckle noise
    - a. What is the cause of speckle noise in ultrasound imaging?
    - b. What is the characteristic length of speckle noise?
    - c. How can speckle noise be mitigated?

#### Questions?

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