TBMT14 – Written theoretical assignment (1.5 hp) Valid thru 2015-12-31
Marcus Larsson, Examiner 2015

Written theoretical assignment - General guidelines:

- The assignment should be individually written in English or Swedish.
- Max 1500 words (figures and equations are not included).
- The declaration on the next page should be signed and placed in the mailbox of Marcus Larsson (IMT floor 12) no later than one week before the final presentation.
- Mail (as an attachment) the assignment no later than one week before the final presentation to: **marla29.liu@analys.urkund.se**

LSI project

The report should describe what happens when photons that have propagated thru a tissue, perfused by moving red blood cells, are backscattered to the surface and detected by an imaging sensor. This include topics such as:

- The interaction between a photon and a moving red blood cells, i.e. a single Doppler shift.
- The formation of a laser speckle pattern (a.k.a. interference pattern).
- The mixing of a Doppler shifted photon and non-Doppler shifted photon, and how it effects the dynamics of the speckle pattern.
- The relationship between the speckle dynamics and the local contrast (a.k.a. LASCA).
- Limitations, simplifications and applicability of the described model.

With the above proposed topics you will be able to give a more or less theoretical description of how the local contrast relates to the blood flow. Be aware that some of the above proposed topics are best described mathematically while other more complex topics are best treated by reasoning in words.

PPG project

The report should describe a model for what happens when photons that have propagated thru a tissue, containing pulsatile blood vessels, are backscattered to the surface and detected by a photodetector. The bio-optical/mathematical model needs to take into account the blood saturation level, arterial pulsations and two different photon wavelength. The report should treat topics such as:

- The interaction between photons and absorbing tissue chromophore.
- The effect of tissue scattering.
- How can blood pulsations be modeled?
- The effect of using two different wavelengths.
- Why look at the AC/DC ratio?
- Solving the inverse of your model, resulting in a mathematical expressions that describes how blood saturation can be calculated from the AC and DC components.
- Limitations, simplifications and applicability of the described model.

With the above proposed topics you will be able to give a more or less theoretical description of the pulse oximetry equations. Be aware that while most of the above proposed topics are best described mathematically, other more complex topics might be best treated by reasoning in words.

TBMT14 – Declaration of individually written report

With my signature I certify that this submission is my own work. All external material, i.e. anything not being my own reasoning and/or written by me, is distinctly quoted or paraphrased and given a clear reference to the source. This applies to literature, web pages as well as other people's ideas.

Sign: _____

Name (readable): _____

LiU-ID: _____

Date: _____