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Quantitative and localized spectroscopy for non-invasive bilirubinometry in neonates

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Publication date
2012

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Citation for published version (APA):

Bosschaart, N. (2012). *Quantitative and localized spectroscopy for non-invasive bilirubinometry in neonates*. [Thesis, fully internal, Universiteit van Amsterdam].

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List of symbols

general

t	time
f	frequency
λ	wavelength
k	wave number
d	depth
ℓ	geometrical path length
$\Delta\lambda$	wavelength resolution
Δk	wave number resolution
Δf	frequency resolution
$h\nu$	photon energy
\varnothing	diameter
r	radius
D	thickness

optical properties

μ_t	attenuation coefficient
μ_a	absorption coefficient
μ_s	scattering coefficient
μ_s	reduced scattering coefficient
μ_b	backscattering coefficient
$\mu_{b,NA}$	NA-corrected μ_b
μ_{eff}	effective attenuation coefficient
$p(\theta)$	scattering phase function
g	scattering anisotropy
n	phase refractive index
n_g	group refractive index
a	scattering scaling factor
b	scatter power
c	chromophore concentration

diffusion theory

I	spectral intensity
R	remittance
r_j	fiber distance from source
z_0	modeled source position
z_b	modeled virtual source position
A	empirical parameter
α	proportionality factor
β, γ	validity limiting parameters

LCS signal description

E_S	electric field in the sample arm
E_R	electric field in the reference arm
E_D	electric field at the detector
I_S	sample arm intensity
I_R	reference arm intensity
i_D	photo detector current
i_{AC}	AC photo detector current
S	power spectrum

LCS system and geometry

x_S	sample arm length
x_R	reference arm length
ΔL	optical path length difference
λ_0	center wavelength
λ_{FWHM}	wavelength bandwidth
l_c	coherence length
S_0	source power spectrum
T_c	system coupling efficiency
ζ	system calibration constant
α	scaling factor
ℓ_F	focus position in path length units
Z_R	Rayleigh length
w	beam waist
Ω	solid angle
θ	(focusing) angle
M	number of modes

LCS acquisition

Δx_S	sample arm displacement
Δx_R	reference arm displacement
v_R	reference mirror velocity
f_R	reference mirror scanning frequency
ΔR	reference mirror scanning amplitude
$\Delta \ell$	path length scanning window
N	number of samples
f_s	sampling frequency

Brownian motion

Δf_D	Doppler frequency shift
k_B	Boltzmann constant
T	temperature
η	viscosity

LCS spectroscopic detection

η_S, η_R	sample/reference arm fraction
$d_{max}, \Delta L_{max}$	imaging depth/path length
$\delta k, \delta \lambda$	spectrometer pixel width
N_p	# pixels
τ	integration time
f_D	Doppler frequency
ε	detection efficiency
$\Delta \ell_R$	reference mirror scanning window
$\Delta \ell_S$	spectrograph probing window

(**bold-faced** printed characters in this thesis denote wavelength dependent parameters)