Quantitative and localized spectroscopy for non-invasive bilirubinometry in neonates

Bosschaart, N.

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## List of symbols

### general
- \( t \) time
- \( f \) frequency
- \( \lambda \) wavelength
- \( k \) wave number
- \( d \) depth
- \( \varepsilon \) geometrical path length
- \( \Delta \lambda \) wavelength resolution
- \( \Delta k \) wave number resolution
- \( \Delta f \) frequency resolution
- \( h \) photon energy
- \( \phi \) diameter
- \( r \) radius
- \( D \) thickness

### optical properties
- \( \mu_t \) attenuation coefficient
- \( \mu_a \) absorption coefficient
- \( \mu_s \) scattering coefficient
- \( \mu_s^{\text{red}} \) reduced scattering coefficient
- \( \mu_b \) backscattering coefficient
- \( \mu_{b,\text{NA}} \) NA-corrected \( \mu_b \)
- \( \mu_{\text{eff}} \) 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
- \( \alpha \) proportionality factor
- \( \beta, \gamma \) validity limiting parameters

### LCS system and geometry
- \( x_S \) sample arm length
- \( x_R \) reference arm length
- \( \Delta L \) optical path length difference
- \( \lambda_0 \) center wavelength
- \( \lambda_{\text{FWHM}} \) wavelength bandwidth
- \( l_c \) coherence length
- \( S_0 \) source power spectrum
- \( T_c \) system coupling efficiency
- \( \zeta \) system calibration constant
- \( \alpha \) scaling factor
- \( \xi_f \) focus position in path length units
- \( Z_R \) Rayleigh length
- \( w \) beam waist
- \( \Omega \) solid angle
- \( \Theta \) (focusing) angle
- \( M \) number of modes

### LCS acquisition
- \( \Delta x_s \) sample arm displacement
- \( \Delta x_R \) reference arm displacement
- \( \nu_R \) reference mirror velocity
- \( f_R \) reference mirror scanning frequency
- \( \Delta R \) reference mirror scanning amplitude
- \( \Delta \xi \) path length scanning window
- \( N \) number of samples
- \( f_s \) sampling frequency

### Brownian motion
- \( \Delta f_D \) Doppler frequency shift
- \( k_B \) Boltzmann constant
- \( T \) temperature
- \( \eta \) viscosity

### LCS spectroscopic detection
- \( n_{S,s}, n_{R,s} \) sample/reference arm fraction
- \( d_{\text{max}}, \Delta L_{\text{max}} \) imaging depth/path length
- \( \delta k, \delta \lambda \) spectrometer pixel width
- \( N_p \) # pixels
- \( \tau \) integration time
- \( f_0 \) Doppler frequency
- \( \varepsilon \) detection efficiency
- \( \Delta \xi_R \) reference mirror scanning window
- \( \Delta \xi_s \) spectrograph probing window

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