Nomenclature

Abbreviations

ADC	Analog to digital converter
ARUI	Add-only recursive ultrasound imaging
B-mode	Brightness mode
CFM	Color flow mapping
CRUI	Classical recursive ultrasound imaging
CW	Continuous wave
F-number	Ratio between the distance to focus and width of aperture
FM	Frequency modulation
GRUI	Generalized recursive ultrasound imaging
GSAU	Generic synthetic aperture ultrasound (imaging)
GSNR	Gain in signal to noise ratio
IMSLR	Integrated main to side lobe ratio
HRI	High resolution image
LRI	Low resolution image
ML	Main lobe
NDT	Non-destructive testing
PM	Phase modulation
PSF	Point spread function
PSNR	Peak signal to noise ratio
RF	Radio frequency
RMS	Root mean square
RUI	Recursive ultrasound imaging
SAD	Sum of absolute differences
SAR	Synthetic aperture radar
SNR	Signal to noise ratio
SRAU	Synthetic receive aperture ultrasound (imaging)
STAU	Synthetic transmit aperture ultrasound (imaging)
STRAU	Synthetic transmit and receive ultrasound imaging
TGC	Time gain compensation curve

Symbols

a_j	Apodization coefficient of element j

a_{ij}	Apodization coefficient for element j after emission with element i
$a_r(x,y)$	Receive apodization function
$a_t(x,y)$	Transmit apodization function
$a_{t/r}(x,y)$	Transmit/receive apodization function
$\mathsf{A}_t(x,y;z)$	Transmit radiation pattern at distance z from the transducer
$\mathsf{A}_r(x,y;z)$	Receive sensitivity function at distance z from the transducer
$\mathsf{A}_{t/r}(x,y;z)$	Two-way radiation pattern at depth z
B	Fractional bandwidth
c	Speed of sound
d_x	Transducer pitch
D	Transducer width
D_{act}	Width of the active aperture
D_{cluster}	The size of a cluster of elements
E_s	Energy of the signal
$f_\#$	F-number
f_0	Center (carrier) frequency
f_i	Instantaneous frequency
$f_{fr\ \text{method}}$	Frame rate of the "method"
$f_m(\vec{x})$	Scatterer function
f_{prf}	Pulse repetition frequency
f_s	Sampling frequency
f_x	Spatial frequency along x
f_y	Spatial frequency along y
$\vec{f}$	Force
$\vec{f}_B$	Body force per unit volume
$\vec{f}_S$	Surface force per unit area
F	Distance to a fixed (mechanically) focal point
$g(t)$	RF pulse
h	Height, for transducer this is the width in elevation plane
$h(t)$	Impulse response
$h_m(t)$	Impulse response of a matched filter
h_{pe}	Pulse echo impulse response
$\mathbf{H}_N$	Hadamard matrix of order N
$H^{(n)}(t)$	High resolution scan line formed at emission n
$H_i(t)$	High resolution scan line formed after transmission with element i
$\mathbf{H}^{(n)}(t)$	High resolution image formed at emission n
$\mathbf{H}_i(t)$	High resolution image formed after transmission with element i
k	Wavenumber
k_x	Projection of k on the x axis
k_y	Projection of k on the y axis
k_z	Projection of k on the z axis
L	Length (lateral size) of a synthetic aperture
L_{arc}	Length of an arc
L_{seg}	Length of a segment
$L^{(n)}(t)$	Low resolution scan line formed at emission n
$L_i(t)$	Low resolution scan line formed after emission with element i
$\mathbf{L}^{(n)}(t)$	Low resolution image formed at emission n

$\mathbf{L}_i(t)$	Low resolution image formed after transmission with element i
m	Scaling coefficient
$M\ n$	Emission number
n_{int}	Interpolated value of n
N_s	Number of samples
N_c	Number of estimates over which the cross-correlation is averaged
N_l	Number of lines in image
N_{act}	Number of active elements
$N_{parallel}$	Number of parallel beamformers
N_{pos}	Number of positions
N_{rcv}	Number of receive elements
N_{xmt}	Number of transmit elements, number of emissions
N_{xdc}	Number of transducer elements
N_x	Number of elements in x direction
N_y	Number of elements in y direction
$N_{x;\ \mathrm{skip}}$	Number of skipped elements along x
$\vec{n}$	Normal vector
p	Pressure
p_i	Incident pressure
p_t	Transmitted pressure
p_0	Ambient pressure
$p_r(\vec{x},t)$	Pulse echo response
$\mathbf{p}_0$	PSF of a low resolution image at azimuth angle 0
$\mathbf{P}$	PSF of a high resolution image
P_N	Power of the noise
$q_i^{(n)}$	Encoding coefficient applied on the signal of the ith channel
$\mathbf{Q}$	Encoding matrix
r	Radius in polar coordinate system, traveled distance
$r(t)$	Received signal
$r(t,x_i)$	Received signal by the element with spatial location x_i, $r(t,x_i) \equiv r_i(t)$
r_{max}	Maximum distance
r_{min}	Minimum distance
$r_j(t)$	Signal received by element j
$r_j^{(n)}(t)$	Signal received by element j after the nth emission
$r_{ij}(t)$	Signal received by element j after emission with element i
R	Radius
$R_{ss}(\tau)$	Auto correlation function of $s(t)$
$R_{mn}(\tau)$	Cross correlation between signal m and n
$s(t)$	Signal, scan line of an image
S	Closed surface
t	Time relative to the start of emission (fast time)
t_s	Time shift
T_{acq}	Time for acquisition of an image
T_{prf}	Pulse repetition period
T_s	Accumulated time shift
u	Particle velocity
v_n	Normal component of the velocity

$\vec{v}$	Velocity
$\vec{v}_0$	Ambient velocity
V	Volume
w	Width of a transducer element
w_v	Width of a virtual element
$w(t)$	Windowing function in time
$w[n]$	Discrete windowing function
$\vec{x}$	Point in space $\vec{x} = (x, y, z)$
$\vec{x}_i$	Position of the center of element i
$\vec{x}_f$	Focal point
$\vec{x}_c$	Reference point for delay calculation (center focus)
Z	Acoustic impedance
z	Depth

Greek symbols

α	Angle of divergence
β	Angle of rotation, angle between a blood vessel and the z axis
γ	Angle between a blood vessel and the beam
$\delta(t)$	Dirac delta function
Δ_f	RMS bandwidth
Δ_t	RMS duration
Δm	Mass
Δt	Elapsed time; time step
$\Delta\theta$	Sector size
$\delta_{\theta N\mathrm{dB}}$	Angular beamwidth (in azimuth plane) at a level of $-N$ dB
$\delta_{\phi N\mathrm{dB}}$	Angular beamwidth (in elevation plane) at a level of $-N$ dB
$\delta_{xN\mathrm{dB}}$	Beamwidth along x (in azimuth plane) at a level of $-N$ dB
$\delta_{yN\mathrm{dB}}$	Beamwidth along y (in elevation plane) at a level of $-N$ dB
$\delta_{zN\mathrm{dB}}$	Pulse length along z
ε	Difference, sum of absolute differences
η	Lag in space
θ	Azimuth angle
θ_i	Angle of incidence
θ_r	Angle of reflection
θ_t	Angle of transmission
θ_{step}	Step between two scan lines in a phased array image
θ_{min}	The minimum (starting) angle of a phased array image
θ_{max}	The maximum (ending) angle of a phased array image
κ	Compressibility
λ	Wavelength
ξ	Spatial lag
ρ	Density
ρ	Normalized correlation
ρ_0	Ambient density
σ	Standard deviation
Σ	Aperture area
τ	Delay, lag

τ_{ij}	Delay of the signal received by element j after emission with i
ϕ	Elevation angle
φ	Phase
Φ	Velocity potential
ω	Angular frequency

Other symbols

$g(t) \rightleftharpoons G(f)$	Fourier transform pair
$\vec{\cdot}$	Vector of $\cdot$
$\hat{\cdot}$	Estimate of $\cdot$
$\vdots$	Complex value of $\cdot$
$\vdots^*$	Complex conjugate of $\vdots$
$\angle(\vec{x},\vec{y})$	Angle closed by $\vec{x}$ and $\vec{y}$
$\cdot^{(n)}$	Pertaining to the nth emission
$\lvert\cdot\rvert$	Euclidean norm of the vector
$*$	Convolution
$\underset{t}{*}$	Convolution in time
$\underset{x}{*}$	Convolution in space
$\Delta\cdot$	Fraction of $\cdot$
$\bar{\cdot}$	Mean of $\cdot$
$\mathcal{F}\{\cdot\}$	Fourier transform of $\cdot$
$\mathcal{R}[\beta]\{\cdot;\vec{x}_0\}$	Rotation of $\cdot$ with angle β round a pivotal point $\vec{x}_0$
$\mathcal{T}[\Delta\vec{x}]\{\cdot\}$	Translation with $\Delta\vec{x}$ of $\cdot$