IntegrIT
Embedded Software Design House

NatureDSP BaseBand

Overview

IntegrIT Nature BaseBand is a collection of signal processing functions needed for implementation of digital signal processing algorithms. Rich set of high-level function is targeted for implementation of LTE, DVB and WiMax front-ends. All functions are manually optimized for target platform and provide utmost computational performance. Usage of this library shortens product time-to-market and makes development and prototyping very cost effective.

Main Features of NatureDSP Signal+

- Highly optimized for Tensilica ConnX BaseBand DSP (BBE16)
- Highly optimized for Texas Instruments C64/C64+ DSP
- True fixed point implementation with saturation, no floating point
- x86 version is available for Microsoft Visual Studio and GCC for bit exact software simulation on desktop computer

Applications

- SDR
- LTE
- DVB
- WiMAX

NatureDSP BaseBand Library API

Function	Description
FIR filters and related functions	
bkfir()	Block real FIR filter. Passes real input data through a direct-form FIR filter with real coefficients
cxfir()	Block complex FIR filter. Passes complex input data through a direct-form FIR filter with complex coefficients
rcfir()	Block complex FIR filter. Passes complex input data through a direct-form FIR filter with real coefficients
srfir()	Block real FIR filter with symmetrical impulse response. Passes real input data through a direct-form FIR filter with real coefficients
srcfir()	Block complex FIR filter with symmetrical impulse response. Passes complex input data through a direct-form FIR filter with real coefficients
firdec()	Decimating complex FIR filter w/ real coefficients. Passes complex input signal through a direct-form FIR filter with real coefficients and decimates the output signal.
firinterp()	Interpolating complex FIR filter w/ real coefficients. Upsamples complex input signal and passes it through a direct-form FIR filter with real coefficients.
IIR filters	
convol()	Convolution between complex input signal and complex reference signal.
corr()	Correlation between complex input signal and complex reference signal.
acorr()	Autocorrelation for a complex data vector (positive side only)
despread()	special kind of correlation with QPSK reference signal
lms()	Block-wise delayed LMS algorithm for complex data and complex filter coefficients
Vector mathematics	
rvdot()	Real vector product
cvdot()	Complex vector product
rvadd()	Real vector sum
cvadd()	Complex vector sum
vpower()	Sum of squares of a vector
vmag()	Square root of sum of squares
vnorm()	Vector normalization
vrecip16()	Vector reciprocal
vdivide()	Vector divide
vbexp()	Common block exponent
vlogn()	Natural logarithm
vlog2()	Base-2 logarithm
vlog10()	Base 10 logarithm
vsine()	Sine

Contacts
support@integrit.com
Tel: +7 495 545 46 42

vcos()	Cosine
vtan()	Tangent
vatan2_16()	4-quadrant arctangent
vatan16()	Arctangent
Matrix operations	
matmul(),matvmul()	Real matrix/vector multiply
cmatmul(),cmatvmul()	Complex matrix/vector multiply
mattran()	Real matrix transpose
cmattran()	Complex matrix transpose
cmatherm()	Calculate matrix Hermitian
Cholesky	
chol()	Cholesky decomposition of positive defined Hermitian matrix
cholFwd()	Forward recursion for Cholesky decomposition
cholBkw()	Backward recursion for Cholesky decomposition
cholDet()	Calculate matrix determinant after Cholesky decomposition
FFT	
cfft()	Computes a complex nx-point FFT. Precision 16x16, length from 16 to 32K in steps of 2^N
cifft()	Computes a inverse complex nx-point FFT. Precision 16x16, length from 16 to 32K in steps of 2^N
cnfft()	Mixed radix FFT of size N = $12 \cdot 2^{k0} \cdot 3^{k1} \cdot 5^{k2}$ and N<=1296 or N=1536.
cinfft()	Mixed radix inverse FFT of size N = $12 \cdot 2^{k0} \cdot 3^{k1} \cdot 5^{k2}$ and N<=1296 or N=1536.
rfft()	Real forward FFT. Precision 16, length from 16 to 32K in steps of 2^N
rifft()	Real inverse FFT. Precision 16, length from 16 to 32K in steps of 2^N
Communications	
crc()	Compute 8, 16, 24 and 32 bit CRC
slicerh()	Calculate hard decision for QPSK, QAM16, QAM64 constellations
qammap()	Map bits to QPSK, QAM16 or QAM64 constellation
gcode()	Universal Gray coding/QAM mapping
bsegmnt()	Bitstream unpacking – convert stream of 1, 2, 4, 6, 8 bits to stream of 16-bit words
bpack()	Bitstream packing – convert stream of 16-bit words to stream of 1, 2, 4, 6, 8 bits
convenc()	Convolution encoder

Availability

This library is available in binaries and in source code written on fully portable C-language for:

- Tensilica ConnX BBE16
- TMS320C64xx, OMAP, DaVinci
- x86 Microsoft Visual Studio
- x86 GCC

Detailed API and performance are available up on request. **IntegrIT** offers services of software porting on customers platform.

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