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GDD-300 Floating Point DSP Vector Library for TMS320C67x, C62xx/C64xx

The library is a set of over 100 functions and macros that perform commonly used DSP operations like Fast Fourier Transform, Fast Hartley Transform, Discrete Cosine Transform, FIR/IIR filters, coordinate transformations, vector operations, complex number arithmetic operations, pseudo-random numbers generation, data conditioning (spectral windows) operations. These operations are performed on the IEEE-754 floating point format numbers. There is also a set of data conversions functions to convert floating point data to/from integer and Q15 fixed point formats.

The library implements complete Level 1 BLAS (Basic Linear Algebra Subroutines) standard.

The library is supported for use in any development environment using TI Code Generation Tools for the TMS320C67x, C62xx/C64xx DSP.

Library's functions have been optimised algorithmically at the assembly level to fully utilize advantages of TMS320C67x, C62xx/C64xx parallel architecture, floating point arithmetic and pipeline. All functions are hand-coded in assembly to obtain maximum possible performance on the TMS320C67x, C62xx/C64xx floating-point DSP.

The library can be used in various application areas such as DSP, audio/video processing, linear algebra, engineering, control, robotics, military and consuming. The user's manual gives the details on using library functions.

FUNCTIONS

• Transforms

- Initialise Complex FFT twiddle factor table
- Complex Forward FFT
- Complex Inverse FFT
- Complex Forward/Inverse FFT (driver)
- Initialise Real FFT twiddle factor table
- Real Forward FFT
- Real Inverse FFT
- Initialise FHT twiddle factor table
- Forward/Inverse Fast Hartley Transform (FHT)
- Convert FHT to real FFT
- Convert real FFT to FHT to FHT
- Initialise Complex CT twiddle factor table
- Real Forward Cosine Transform
- Real Inverse Cosine Transform
- DSP FUNCTIONS
- Linear auto-covariation (autocorrelation) function
- Linear cross-covariation (crosscorrelation) function
- General Form Difference Equation (IIR Filter)
- Difference Equation with two zeroes and two poles (IIR Filter)
- Linear convolution
- FIR filter (macro)
- Decimation and FIR filter
- Convert to dB (power/voltage units)
- Histogram Accumulation
- Auto-Spectrum Accumulation
- Cross-Spectrum Accumulation
- Coherence Function
- Transfer Function
- Exponential Averaging
- Linear Averaging
- Hanning (cosine) window
- Hamming window
- Blackman window
- Bartlett window
- Parzen window
- Welch window

• Vector Operations (Real Data)

- Index of a vector entry with maximum magnitude
- Index of a vector entry with minimum magnitude
- Index of the maximum vector element
- Index of the minimum vector element
- Sum of absolute values of vector elements
- Sum of vector elements
- L2 (Euclidean) Norm of a vector
- Copy vector to a vector
- Fill a vector with a constant
- Dot (inner) product
- Swap two vectors
- Scale a vector, add to another vector (macro)
- Scale a vector, add to another vector, store to an output vector
- Add a constant to a vector (macro)
- Add a constant to a vector, store to an output vector
- Scale a vector (macro)
- Scale a vector, store to an output vector
- Add entries of two vectors (macro)
- Add entries of two vectors, store to an output vector
- Subtract entries of two vectors (macro)
- Subtract entries of two vectors, store to an output vector
- Multiply entries of two vectors (macro)
- Multiply entries of two vectors, store to an output vector
- Divide entries of two vectors (macro)
- Divide entries of two vectors, store to an output vector
- Construct Givens plane rotations
- Apply Givens plane rotations (macro)
- Apply Givens plane rotations, different input/output vectors

• Vector Operations (Complex Data)

- Index of a vector entry with maximum magnitude
- Index of a vector entry with minimum magnitude
- Sum of absolute values of vector elements
- Sum of vector elements
- L2 (Euclidean) Norm of a vector
- Copy vector to a vector
- Fill a vector with a constant
- Dot (inner) product, conjugate first vector
- Dot (inner) product
- Swap two vectors
- Scale a vector, add to another vector (macro)
- Scale a vector, add to another vector, store to an output vector
- Scale a conjugated vector, add to another vector (macro)
- Scale a conjugated vector, add to another vector, store to an output vector
- Add a constant to a vector (macro)
- Add a constant to a vector, store to an output vector
- Scale a vector (macro)
- Scale a vector, store to an output vector
- Scale a vector by a real scalar (macro)
- Scale a vector by a real scalar, store to an output vector
- Add entries of two vectors (macro)
- Add entries of two vectors, store to an output vector
- Subtract entries of two vectors (macro)
- Subtract entries of two vectors, store to an output vector
- Multiply entries of two vectors (macro)
- Multiply entries of two vectors, store to an output vector
- Divide entries of two vectors (macro)
- Divide entries of two vectors, store to an output vector
- Construct Givens plane rotations
- Apply Givens plane rotations (macro)
- Apply Givens plane rotations, different input/output vectors

• Data Conversions

- Rectangular to polar coordinate transform
- Polar to rectangular coordinate transform
- Combine two real arrays into a complex array
- Split a complex array into two real arrays
- Convert a Q15 array into a real array
- Convert a real array into a Q15 array
- Convert a 32-bit integer array into a real array
- Convert a real array into a 32-bit integer array

• Scalar Operations

- Compute bit-reversed number of 16 bit short integer
- Compute bit-reversed number of 32 bit integer
- Square root of sum of squares
- Sum of magnitudes of real and imaginary parts of a complex number
- Magnitude of a complex number
- Conjugate of a complex number
- Square root of a complex number
- Complex sign transfer
- Add two complex numbers
- Add two complex numbers, conjugate first number
- Add two complex numbers, conjugate second number
- Multiply two complex numbers
- Multiply two complex numbers, conjugate first number
- Multiply two complex numbers, conjugate second number
- Multiply two complex numbers, add a complex number
- Multiply two complex numbers, add a complex number, conjugate second number
- Multiply two complex numbers, add a complex number, conjugate third number
- Divide two complex numbers
- Divide two complex numbers, conjugate first number
- Divide two complex numbers, conjugate second number
- Subtract two complex numbers
- Subtract two complex numbers, conjugate first number
- Subtract two complex numbers, conjugate second number
- Base e (natural) logarithm of a complex number
- Base e exponential function of a complex number
- Cosine of a complex number
- Sine of a complex number
- Complex number raised to an integer power
- Complex number raised to a complex number power

• Miscellaneous

- In-place bit-reverse permutation of a real array
- In-place bit-reverse permutation of a complex array
- Bit-reversed copy of a real array
- Bit-reversed copy of a complex array
- Conjugated copy of a complex array
- Negated copy of a real array
- Negated copy of a complex array
- Magnitudes of entries of a complex array
- Reciprocal entries of a real array
- Parameters of machine real arithmetic
- Parameters of machine complex arithmetic
- Set (restore) state of the random generator
- Get (save) state of the random generator
- Get maximum integer random number (macro)
- Integer Uniform Random Number Generator
- Fill a vector with random numbers on (a,b)
- Floating Point (0,1) Uniform Random Number Generator (macro)
- Floating Point (a,b) Uniform Random Number Generator (macro)