C/C++ : fftw Tutorial

By totosugito on July 10, 2012

C/C++ : fftw Tutorial

FFTW is a C subroutine library for computing the discrete Fourier transform (DFT) in one or more dimensions, of arbitrary input size, and of both real and complex data. I use this library for compute FFT because the library is fast and simple to use. This is my **fftw tutorial**. So, from this **fftw tutorial**, you can know how to use **fftw library** to process

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your data.

I create four function in this **fftw tutorial**. The function is **how to compute fft and ifft** for your data with input/output in floating point and double data format. You can use this **fftw tutorial** function like at Matlab function. When using fft and ifft in Matlab, we can use this command :

```
B = fft(A)
B = fft(A, nfft)
C = ifft(B)
C = ifft(B, nfft)
```

You can use my **fftw tutorial** function like the Matlab parameter :

```
B = fftwf_data(A, lenA, nfft);
C = ifftwf_data(B, lenC, nfft);
```

The fftw accepted input data with **fftwf_complex** (floating point data format) and **fftw_complex** (double data format). This data format (**fftwf_complex** and **fftw_complex**) is an array 2D with length of colum = 2. The first column is real data and the second column is imaginer data.

This is the sample main program for this **fftw tutorial** for more explanation how to use **fftw library** in our program (**fftw sample code**).

```
/*
 * main.c
 *
 *  Created on: Jul 10, 2012
 *      Author: toto
 */

```

```
 8 #include <stdio.h>
 9 #include <string.h>
10 #include <math.h>
11 #include <stdlib.h>
12 #include <time.h>
13 #include <fftw3.h>
14
15 int main( int argc, char** argv )
16 {
17     fftwf_complex *data;
18     fftwf_complex *fdata;
19     fftwf_complex *idata;
20     int ndata, nfft, i;
21     unsigned int seed = 1234;
22
23     if(argc<2)
24         return(1);
25     sscanf(argv[1], "%i", &ndata);
26     sscanf(argv[2], "%i", &nfft);
27
28     //allocate memory for data
29     data = ( fftwf_complex* ) fftwf_malloc( sizeof( ff
30
31     // CREATE INPUT DATA
32     srand ( seed );
33     for( i=0; i<ndata; i++ ) {
34         data[i][0] = (double) (rand()/12345678);    //
35         data[i][1] = 0.0;       //imaginer data
36     }
37     //print input data
38     printf("Input Data \n");
39     for( i = 0 ; i < ndata ; i++ )
40         printf( "%i.  %2.5f  %2.5f \n", i, data[i][0],
41
42     // FFT PROCESS
43     fdata = fftwf_data(data, ndata, nfft);
44     printf("\nFFT Result \n");
45     for( i = 0 ; i < nfft ; i++ )
46         printf( "%i.  %2.5f  %2.5f \n", i, fdata[i][0]
```

```
47
48      // INVERS FFT PROCESS
49      idata = ifftwf_data(fdata, ndata, nfft);
50      printf("\nIFFT Result \n");
51      for( i = 0 ; i < ndata ; i++ )
52          printf( "%i.  %2.5f  %2.5f \n", i, idata[i][0]
53      printf("\n");
54
55      fftwf_free( data );
56      fftwf_free( fdata );
57      fftwf_free( idata );
58
59      return 0;
60  }
```

This is the sample output from this **fftw tutorial code** :

```
1   toto@toto-laptop:~/Desktop$ fftw_demo 5 10
2   Input Data
3   0.  38.00000  0.00000
4   1.  37.00000  0.00000
5   2.  77.00000  0.00000
6   3.  85.00000  0.00000
7   4.  99.00000  0.00000
8
9   FFT Result
10  0.  336.00000  0.00000
11  1.  -14.63119  -234.00996
12  2.  -51.03444  63.66779
13  3.  63.63119  -34.12248
14  4.  -21.96556  28.83423
15  5.  92.00000  0.00000
16  6.  -21.96556  -28.83423
17  7.  63.63119  34.12248
18  8.  -51.03444  -63.66779
19  9.  -14.63119  234.00996
20
21  IFFT Result
```

```
22 | 0.  38.00000  0.00000
23 | 1.  37.00000  0.00000
24 | 2.  77.00001  0.00000
25 | 3.  85.00000  0.00000
26 | 4.  99.00000  0.00000
```

If you compare the value from this **fftw tutorial**, you will get the same value from Matlab. You can donwload the complete code from this **fftw tutorial** at here.

Source :

http://www.fftw.org/

totosugito

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Boa Tarde Toto.

o programa não funcionou. qual é a utilidade do arquivo Makefile?

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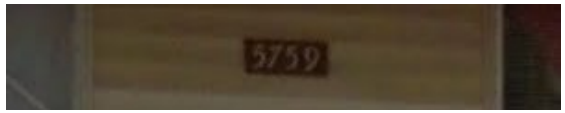

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