

FFT Library

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1 Revision History

Date	Version	Notes
Date 1	1.0	Notes
Date 2	1.1	Notes

2 Symbols, Abbreviations and Acronyms

symbol	description
T	Test

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3 General Information

The following section provides an overview of the Verification and Validation (V & V) Plan for a FFT library.

3.1 Purpose

The main purpose of this document is to describe the verification and validation process that will be used to test a FFT Library. This document is intended to be used as a reference for all future testing and will be used to increase confidence in the software implementation.

This document will be used as a starting point for the verification and validation report. The test cases presented within this document will be executed and the output will be analyzed to determine if the library is implemented correctly.

3.2 Scope

The whole library includes four FFT or IFFT calculation functions. All tests should be applied based on this scope.

3.3 Overview of Document

The following sections provides more details about the V&V of a FFT Library. Information about verification tools, automated testing approaches will be stated. And test cases for all system testing and part of unit testing will be provided.

4 Plan

4.1 Software Description

The software being tested is a library for FFT algorithm. Users choose different FFT or IFFT functions and give proper input datas to complete a FFT or IFFT calculation. The library includes radix-2 and radix-3 FFT (and IFFT) calculation functions.

4.2 Test Team

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4.3 Automated Testing Approach

A unit testing framework will be implemented in both unit testing and system testing.

Script will be used to call all the test cases in test suite.

Test coverage analysis will be applied to measure code coverage.

Compiler can do syntax check automatically.

4.4 Verification Tools

1. Cutest as unit testing framework
2. Make as script to call test cases and execute test
3. Xcover as coverage analysis tool

4.5 Non-Testing Based Verification

Symbolic Execution

Because FFT library is based on a mathematical expression. Using Symbolic Execution can trace the path and the result can be compared with mathematical expression directly.

5 System Test Description

5.1 Tests for Functional Requirements

5.1.1 Calculation Test

Radix-2 Complex Number Calculation Function

1. Radix-2 Complex Number FFT Calculation Function

Type: Functional, Dynamic, Automated

Initial State: None

Input:

input.txt : Includes all the input datas. Two examples of input.txt are shown in Figure 3 and Figure 4.

expectedOutput.txt: Includes the output datas using the same input datas but computed by Matlab FFT library. Then output.txts are shown in Figure 3 and Figure 4.

If the numbers of data can not satisfy 2^n , program will automatically fill with 0.

Output: output.txt : Includes the output datas using the input data computed by this FFT library.

TestResult: pass or not pass. Whether the program passed the test is measured by an admissible error and the algorithm for the admissible error is provided as below:

How test will be performed:

Automated. For validation purpose, datas should also be compared with results from normal DFT calculations manually.

2. Radix-2 Complex Number IFFT Calculation Function

Type: Functional, Dynamic, Automated

Initial State: None

Input: input.txt, expectedOutput.txt

Output: output.txt, TestResult: pass or not pass

How test will be performed:

Same as above.

Radix-2 Real Number Calculation Function

1. Radix-2 Real Number FFT Calculation Function

Type: Functional, Dynamic, Automated

Initial State: None

Input: input.txt, expectedOutput.txt

Output: output.txt, TestResult: pass or not pass

How test will be performed:

Same as above.

2. Radix-2 Real Number IFFT Calculation Function

Type: Functional, Dynamic, Automated

Initial State: None

Input: input.txt, expectedOutput.txt

Output: output.txt, TestResult: pass or not pass

How test will be performed:

Same as above.

Radix-3 Complex Number Calculation Function

1. Radix-3 Complex Number FFT Calculation Function

Type: Functional, Dynamic, Automated

Initial State: None

Input: input.txt, expectedOutput.txt

Output: output.txt, TestResult: pass or not pass

How test will be performed:

Same as above.

2. Radix-3 Complex Number IFFT Calculation Function

Type: Functional, Dynamic, Automated

Initial State: None

Input: input.txt, expectedOutput.txt

Output: output.txt, TestResult: pass or not pass

How test will be performed:

Same as above.

Radix-3 Real Number Calculation Function

1. Radix-3 Real Number FFT Calculation Function

Type: Functional, Dynamic, Automated

Initial State: None

Input: input.txt, expectedOutput.txt

Output: output.txt, TestResult: pass or not pass

How test will be performed:

2. Radix-3 Real Number IFFT Calculation Function

Type: Functional, Dynamic, Automated

Initial State: None

Input: input.txt, expectedOutput.txt

Output: output.txt, TestResult: pass or not pass

How test will be performed:

Same as above.

5.1.2 Loading Library Test

Under Win X86 platform

Type: Functional, Dynamic, Manual

Initial State: None

Input: input.txt

Output: output.txt

How test will be performed: Manual, automated

Under Mac OS platform

Type: Functional, Dynamic, Manual

Initial State: None

Input: input.txt

Output: output.txt

How test will be performed: Manual, automated

5.2 Tests for Nonfunctional Requirements

5.2.1 Speed Comparison Test

Compare Calculation Speed with DFT calculation

Type: Dynamic, automated, Manual

Initial State: None

Input: input.txt

Output: Time

How test will be performed:

Manually compare the time with the time using DFT Library.

5.3 Traceability Between Test Cases and Requirements

6 Unit Testing Plan

[Unit testing plans for internal functions and, if appropriate, output files
—SS]

7 Appendix

This is where you can place additional information.

7.1 Symbolic Parameters

The definition of the test cases will call for SYMBOLIC_CONSTANTS. Their values are defined in this section for easy maintenance.

7.2 Usability Survey Questions?

This is a section that would be appropriate for some teams.

input_Complex.txt - Notepad

File	Edit	Format	View	Help
321	\$	262		
438	\$	410		
128	\$	339		
75	\$	131		
94	\$	206		
237	\$	380		
85	\$	99		
190	\$	285		
235	\$	18		
169	\$	349		
42	\$	228		
173	\$	71		
376	\$	463		
468	\$	452		
3	\$	56		
289	\$	358		
149	\$	275		
267	\$	422		
458	\$	485		
404	\$	144		
291	\$	219		
66	\$	392		
415	\$	112		
387	\$	431		
64	\$	163		
366	\$	495		
372	\$	240		
2	\$	217		
205	\$	476		
297	\$	465		
329	\$	369		
117	\$	371		
479	\$	420		
96	\$	67		
287	\$	497		
233	\$	157		
119	\$	232		
396	\$	37		
244	\$	125		
216	\$	444		
94	\$	176		
194	\$	7		
201	\$	253		
31	\$	230		
34	\$	121		
126	\$	110		
158	\$	382		
447	\$	16		
308	\$	433		
426	\$	80		

Figure 1: System Context

Input_floating.txt - Notepad

File	Edit	Format	View	Help
68.826	\$	1.0079		
12.879	\$	310.37		
76562	\$	39987		
9.6598	\$	26.765		
893.80	\$	0.1534		
38.514	\$	5.4132		
338.37	\$	9472.1		
8.5512	\$	865.80		
8337.6	\$	9.2989		
64.149	\$	50.668		
6455.4	\$	2.2897		
7.4426	\$	463.96		
77.371	\$	84.444		
897.84	\$	737.62		
218.28	\$	7.7631		
36.782	\$	0.6211		
979.25	\$	7589.9		
154.20	\$	968.57		
791.03	\$	0.5806		
256.96	\$	925.84		
91.921	\$	6.7354		
410.55	\$	9.3393		
36.378	\$	6.0540		
8.8053	\$	5.2400		
85.916	\$	588.09		
6.6690	\$	1648.8		
93.653	\$	88.716		
769.67	\$	122.15		
0.6470	\$	50.264		
923.25	\$	39.582		
5092.7	\$	434.50		
6588.1	\$	72.031		
0.0466	\$	4.1718		
4.4518	\$	626.77		
81.644	\$	71.626		
2823.7	\$	584.04		
94.462	\$	33.173		
701.54	\$	592.13		
3891.9	\$	99.802		
1.7151	\$	1.8220		
15.015	\$	2462.8		
957.89	\$	823.08		
96.193	\$	54.536		
79.508	\$	780.35		
0.9011	\$	16.083		
21.424	\$	0.5402		
53468	\$	827.12		
684.22	\$	3.7850		
0.3007	\$	0.7538		
4705.9	\$	0.1938		

Figure 2: System Context

input_Complex.txt - Notepad

File	Edit	Format	View	Help
321	\$	262		
438	\$	410		
128	\$	339		
75	\$	131		
94	\$	206		
237	\$	380		
85	\$	99		
190	\$	285		
235	\$	18		
169	\$	349		
42	\$	228		
173	\$	71		
376	\$	463		
468	\$	452		
3	\$	56		
289	\$	358		
149	\$	275		
267	\$	422		
458	\$	485		
404	\$	144		
291	\$	219		
66	\$	392		
415	\$	112		
387	\$	431		
64	\$	163		
366	\$	495		
372	\$	240		
2	\$	217		
205	\$	476		
297	\$	465		
329	\$	369		
117	\$	371		
479	\$	420		
96	\$	67		
287	\$	497		
233	\$	157		
119	\$	232		
396	\$	37		
244	\$	125		
216	\$	444		
94	\$	176		
194	\$	7		
201	\$	253		
31	\$	230		
34	\$	121		
126	\$	110		
158	\$	382		
447	\$	16		
308	\$	433		
426	\$	80		

Figure 3: System Context

Input_floating.txt - Notepad

File	Edit	Format	View	Help
68.826	\$	1.0079		
12.879	\$	310.37		
76562	\$	39987		
9.6598	\$	26.765		
893.80	\$	0.1534		
38.514	\$	5.4132		
338.37	\$	9472.1		
8.5512	\$	865.80		
8337.6	\$	9.2989		
64.149	\$	50.668		
6455.4	\$	2.2897		
7.4426	\$	463.96		
77.371	\$	84.444		
897.84	\$	737.62		
218.28	\$	7.7631		
36.782	\$	0.6211		
979.25	\$	7589.9		
154.20	\$	968.57		
791.03	\$	0.5806		
256.96	\$	925.84		
91.921	\$	6.7354		
410.55	\$	9.3393		
36.378	\$	6.0540		
8.8053	\$	5.2400		
85.916	\$	588.09		
6.6690	\$	1648.8		
93.653	\$	88.716		
769.67	\$	122.15		
0.6470	\$	50.264		
923.25	\$	39.582		
5092.7	\$	434.50		
6588.1	\$	72.031		
0.0466	\$	4.1718		
4.4518	\$	626.77		
81.644	\$	71.626		
2823.7	\$	584.04		
94.462	\$	33.173		
701.54	\$	592.13		
3891.9	\$	99.802		
1.7151	\$	1.8220		
15.015	\$	2462.8		
957.89	\$	823.08		
96.193	\$	54.536		
79.508	\$	780.35		
0.9011	\$	16.083		
21.424	\$	0.5402		
53468	\$	827.12		
684.22	\$	3.7850		
0.3007	\$	0.7538		
4705.9	\$	0.1938		

Figure 4: System Context