NASL

Optimised FFTW Libraries

Library Overview

Easy to use

Highly optimised for the target processor

Major speed advantages over open source FFTW

No artificial constraints put on data

FFTW

The NASL FFTW library is an optimised implementation of the well-known FFTW library (see http://www.fftw.org/), optimised for the relevant target processor.

Ease of Use

As with the open source FFTW implementations, particular care has gone into making the libraries simple to use.
No artificial constraints are put upon the data. In particular, the libraries automatically handle data distribution issues:

The data can be strided

The data can have any memory alignment

Any data length is permitted (not only multiples of the processor vector length (=4 for the PowerPC74xx))

Complex vector data can be either split or interleaved.

For processors with multiple cores (MIPS, Intel) the NASL FFTW libraries are provided in multithreaded form, making transparent use of the multiple cores.

Efficiency

Every (non-scalar) routine in the library has been specifically optimised for the target processor. The implementations:

block the data. The block sizes are tailored to the processor being
targeted: typically a multiple of 4 or 8.
unroll block loops: the depth of unrolling is optimised and is operation and data size dependent.
prefetch blocks when this is helpful;
re-order and group low level operations such as fetch, prefetch, and arithmetic operations.
Implement advanced cache management strategies;
Implement strategies which depend upon the data details. For
example, aligned and unaligned data are treated separately, as are
vectors with stride 1 (contiguous data); 2 (typically interleaved
complex data); and general strided data
Handle “edge effects”: vector or matrix sizes which are not a multiple of the SIMD length, in a transparent but optimal manner.
Utilise a mix of optimised C and assembler modules.

For complex data routines the data representation may be either split or interleaved: the latter is the default within FFTW. Both
are catered for within the NASL FFTW library; the routines are separately optimised for the two choices of representation.
The libraries provide a substantial performance advantage compared with the open source FFTW libraries

About NASL

N. A. Software Ltd (NASL) was founded in 1978 as a hi-tech spinoff from the University of Liverpool. The company has two main activity areas:

Consultancy

We carry out software and algorithmic research, development and consultancy for a wide range of organisations. Areas of particular expertise include SAR processing; image understanding and analysis; parallelism; scientific and engineering computational techniques, particularly in signal processing.

Software Tools

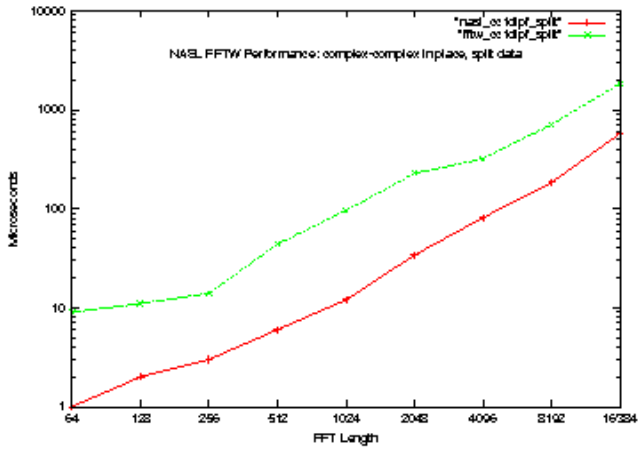
We develop and market a range of innovative software tools including VSIPL and other vector libraries for advanced processors; the Liberator library generator; and the InfoSAR Ltd InfoPACK SAR (Synthetic Aperture Radar) Image Processing package.

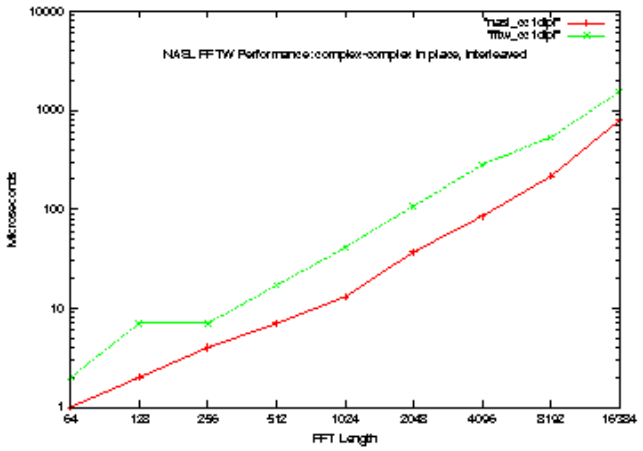
Current release information

The following restrictions apply at the current release:
1. Float variables only: no double or long double routines.
2. 1D and 2D transforms only with optimised support for radix 2, 3, 4, 8, and 16; transforms involving other prime factors are not optimised.
3. Both interleaved and non-interleaved (split) complex data are supported and optimised.
4. Wisdom routines are not supported in this release.
5. Sufficient of the guru interface is implemented to support the computational routines provided, including split complex data.
6. There is limited support for FFTW's FFTWTHREADS mechanism, allowing user control over the number of threads used.

No open-source FFTW code is used in this implementation; but for the routines provided, the FFTW API is adhered to. All implementations show major speed advantages over the open source versions of FFTW.

The graphs below show firstly timings for NASL's FFTW routine ccldipf vs the open source version, using split data on a Motorola 7447 with G4 running at 1GHz followed by interleaved times under the same conditions.





Implementations

PowerPC/G4 Linux
PowerPC/G4 VXWorks

IntelSSE2/SSE4 Linux
IntelSSE2/SSE4 Windows XP/Vista

MIPS64 Linux*

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