Assignment 4 report Mike Chubey 10015534

Code tuning

Loop techniques:

I changed two calls to a function that padded the input signal and the impulse signal and combined them into one loop.

zeroPad(complexX, complexSize);

zeroPad(complexH, complexSize);

...

void zeroPad(double x[], int size) {

for (int i = 0; i < size; i++ ) {

x[i] = 0.0;

}

Was changed into:

for (int i = 0; i < complexSize; i++) {

complexX[i] = 0.0;

complexH[i] = 0.0;

}

However, this ended up adding time to my execution.

Time Measurements

Base program without any optimization:

Flat profile:

Each sample counts as 0.01 seconds.

% cumulative self self total

time seconds seconds calls s/call s/call name

100.00 234.98 234.98 1 234.98 234.98 convolve(float\*, int, float\*, int, float\*, nt)

0.00 234.98 0.00 691618 0.00 0.00 fwriteShortLSB(short, \_iobuf\*)

0.00 234.98 0.00 5 0.00 0.00 fwriteIntLSB(int, \_iobuf\*)

0.00 234.98 0.00 2 0.00 0.00 SoundFile::readInput(char\*)

0.00 234.98 0.00 2 0.00 0.00 std::operator|(std::\_Ios\_Openmode, std::\_Ios\_Openmode)

0.00 234.98 0.00 1 0.00 0.00 writeWaveFileHeader(int, int, int, double, \_iobuf\*)

granularity: each sample hit covers 4 byte(s) for 0.00% of 234.98 seconds

index % time self children called name

234.98 0.00 1/1 main [2]

[1] 100.0 234.98 0.00 1 convolve(float\*, int, float\*, int, float\*, int) [1]

-----------------------------------------------

<spontaneous>

[2] 100.0 0.00 234.98 main [2]

234.98 0.00 1/1 convolve(float\*, int, float\*, int, float\*, int) [1]

0.00 0.00 691614/691618 fwriteShortLSB(short, \_iobuf\*) [4]

0.00 0.00 2/2 SoundFile::readInput(char\*) [6]

0.00 0.00 1/1 writeWaveFileHeader(int, int, int, double, \_iobuf\*) [8]

-----------------------------------------------

0.00 0.00 4/691618 writeWaveFileHeader(int, int, int, double, \_iobuf\*) [8]

0.00 0.00 691614/691618 main [2]

[4] 0.0 0.00 0.00 691618 fwriteShortLSB(short, \_iobuf\*) [4]

-----------------------------------------------

0.00 0.00 5/5 writeWaveFileHeader(int, int, int, double, \_iobuf\*) [8]

[5] 0.0 0.00 0.00 5 fwriteIntLSB(int, \_iobuf\*) [5]

-----------------------------------------------

0.00 0.00 2/2 main [2]

[6] 0.0 0.00 0.00 2 SoundFile::readInput(char\*) [6]

0.00 0.00 2/2 std::operator|(std::\_Ios\_Openmode, std::\_Ios\_Openmode) [7]

-----------------------------------------------

0.00 0.00 2/2 SoundFile::readInput(char\*) [6]

[7] 0.0 0.00 0.00 2 std::operator|(std::\_Ios\_Openmode, std::\_Ios\_Openmode) [7]

-----------------------------------------------

0.00 0.00 1/1 main [2]

[8] 0.0 0.00 0.00 1 writeWaveFileHeader(int, int, int, double, \_iobuf\*) [8]

0.00 0.00 5/5 fwriteIntLSB(int, \_iobuf\*) [5]

0.00 0.00 4/691618 fwriteShortLSB(short, \_iobuf\*) [4]

-----------------------------------------------

FTT algorithm optimization program without any other optimizations:

Flat profile:

Each sample counts as 0.01 seconds.

% cumulative self self total

time seconds seconds calls ms/call ms/call name

96.51 0.83 0.83 3 276.67 276.67 four1(double\*, int, int)

1.16 0.84 0.01 2 5.00 5.00 zeroPad(double\*, int)

1.16 0.85 0.01 main

1.16 0.86 0.01 rint

0.00 0.86 0.00 1048580 0.00 0.00 fwriteShortLSB(short, \_iobuf\*)

0.00 0.86 0.00 5 0.00 0.00 fwriteIntLSB(int, \_iobuf\*)

0.00 0.86 0.00 2 0.00 0.00 SoundFile::readInput(char\*)

0.00 0.86 0.00 2 0.00 0.00 std::operator|(std::\_Ios\_Openmode, std::\_Ios\_Openmode)

0.00 0.86 0.00 1 0.00 0.00 writeWaveFileHeader(int, int, int, double, \_iobuf\*)

granularity: each sample hit covers 4 byte(s) for 1.16% of 0.86 seconds

index % time self children called name

<spontaneous>

[1] 98.8 0.01 0.84 main [1]

0.83 0.00 3/3 four1(double\*, int, int) [2]

0.01 0.00 2/2 zeroPad(double\*, int) [3]

0.00 0.00 1048576/1048580 fwriteShortLSB(short, \_iobuf\*) [6]

0.00 0.00 2/2 SoundFile::readInput(char\*) [8]

0.00 0.00 1/1 writeWaveFileHeader(int, int, int, double, \_iobuf\*) [10]

-----------------------------------------------

0.83 0.00 3/3 main [1]

[2] 96.5 0.83 0.00 3 four1(double\*, int, int) [2]

-----------------------------------------------

0.01 0.00 2/2 main [1]

[3] 1.2 0.01 0.00 2 zeroPad(double\*, int) [3]

-----------------------------------------------

<spontaneous>

[4] 1.2 0.01 0.00 rint [4]

-----------------------------------------------

0.00 0.00 4/1048580 writeWaveFileHeader(int, int, int, double, \_iobuf\*) [10]

0.00 0.00 1048576/1048580 main [1]

[6] 0.0 0.00 0.00 1048580 fwriteShortLSB(short, \_iobuf\*) [6]

-----------------------------------------------

0.00 0.00 5/5 writeWaveFileHeader(int, int, int, double, \_iobuf\*) [10]

[7] 0.0 0.00 0.00 5 fwriteIntLSB(int, \_iobuf\*) [7]

-----------------------------------------------

0.00 0.00 2/2 main [1]

[8] 0.0 0.00 0.00 2 SoundFile::readInput(char\*) [8]

0.00 0.00 2/2 std::operator|(std::\_Ios\_Openmode, std::\_Ios\_Openmode) [9]

-----------------------------------------------

0.00 0.00 2/2 SoundFile::readInput(char\*) [8]

[9] 0.0 0.00 0.00 2 std::operator|(std::\_Ios\_Openmode, std::\_Ios\_Openmode) [9]

-----------------------------------------------

0.00 0.00 1/1 main [1]

[10] 0.0 0.00 0.00 1 writeWaveFileHeader(int, int, int, double, \_iobuf\*) [10]

0.00 0.00 5/5 fwriteIntLSB(int, \_iobuf\*) [7]

0.00 0.00 4/1048580 fwriteShortLSB(short, \_iobuf\*) [6]

FTT algorithm optimization program with compiler optimization –O2:

Each sample counts as 0.01 seconds.

% cumulative self self total

time seconds seconds calls ms/call ms/call name

96.15 0.50 0.50 3 166.67 166.67 four1(double\*, int, int)

3.85 0.52 0.02 main

0.00 0.52 0.00 1048580 0.00 0.00 fwriteShortLSB(short, \_iobuf\*)

0.00 0.52 0.00 5 0.00 0.00 fwriteIntLSB(int, \_iobuf\*)

0.00 0.52 0.00 2 0.00 0.00 SoundFile::readInput(char\*)

0.00 0.52 0.00 1 0.00 0.00 writeWaveFileHeader(int, int, int, double, \_iobuf\*)

Call graph

granularity: each sample hit covers 4 byte(s) for 1.92% of 0.52 seconds

index % time self children called name

<spontaneous>

[1] 100.0 0.02 0.50 main [1]

0.50 0.00 3/3 four1(double\*, int, int) [2]

0.00 0.00 1048576/1048580 fwriteShortLSB(short, \_iobuf\*) [4]

0.00 0.00 2/2 SoundFile::readInput(char\*) [6]

0.00 0.00 1/5 fwriteIntLSB(int, \_iobuf\*) [5]

0.00 0.00 1/1 writeWaveFileHeader(int, int, int, double, \_iobuf\*) [7]

-----------------------------------------------

0.50 0.00 3/3 main [1]

[2] 96.2 0.50 0.00 3 four1(double\*, int, int) [2]

-----------------------------------------------

0.00 0.00 4/1048580 writeWaveFileHeader(int, int, int, double, \_iobuf\*) [7]

0.00 0.00 1048576/1048580 main [1]

[4] 0.0 0.00 0.00 1048580 fwriteShortLSB(short, \_iobuf\*) [4]

-----------------------------------------------

0.00 0.00 1/5 main [1]

0.00 0.00 4/5 writeWaveFileHeader(int, int, int, double, \_iobuf\*) [7]

[5] 0.0 0.00 0.00 5 fwriteIntLSB(int, \_iobuf\*) [5]

-----------------------------------------------

0.00 0.00 2/2 main [1]

[6] 0.0 0.00 0.00 2 SoundFile::readInput(char\*) [6]

-----------------------------------------------

0.00 0.00 1/1 main [1]

[7] 0.0 0.00 0.00 1 writeWaveFileHeader(int, int, int, double, \_iobuf\*) [7]

0.00 0.00 4/5 fwriteIntLSB(int, \_iobuf\*) [5]

0.00 0.00 4/1048580 fwriteShortLSB(short, \_iobuf\*) [4]

FTT algorithm optimization program with compiler optimization –O2 and Jamming hand tuning:

Flat profile:

Each sample counts as 0.01 seconds.

% cumulative self self total

time seconds seconds calls ms/call ms/call name

94.44 0.51 0.51 3 170.00 170.00 four1(double\*, int, int)

5.56 0.54 0.03 main

0.00 0.54 0.00 1048580 0.00 0.00 fwriteShortLSB(short, \_iobuf\*)

0.00 0.54 0.00 5 0.00 0.00 fwriteIntLSB(int, \_iobuf\*)

0.00 0.54 0.00 2 0.00 0.00 SoundFile::readInput(char\*)

0.00 0.54 0.00 1 0.00 0.00 writeWaveFileHeader(int, int, int, double, \_iobuf\*)

Call graph

granularity: each sample hit covers 4 byte(s) for 1.85% of 0.54 seconds

index % time self children called name

<spontaneous>

[1] 100.0 0.03 0.51 main [1]

0.51 0.00 3/3 four1(double\*, int, int) [2]

0.00 0.00 1048576/1048580 fwriteShortLSB(short, \_iobuf\*) [4]

0.00 0.00 2/2 SoundFile::readInput(char\*) [6]

0.00 0.00 1/5 fwriteIntLSB(int, \_iobuf\*) [5]

0.00 0.00 1/1 writeWaveFileHeader(int, int, int, double, \_iobuf\*) [7]

-----------------------------------------------

0.51 0.00 3/3 main [1]

[2] 94.4 0.51 0.00 3 four1(double\*, int, int) [2]

-----------------------------------------------

0.00 0.00 4/1048580 writeWaveFileHeader(int, int, int, double, \_iobuf\*) [7]

0.00 0.00 1048576/1048580 main [1]

[4] 0.0 0.00 0.00 1048580 fwriteShortLSB(short, \_iobuf\*) [4]

-----------------------------------------------

0.00 0.00 1/5 main [1]

0.00 0.00 4/5 writeWaveFileHeader(int, int, int, double, \_iobuf\*) [7]

[5] 0.0 0.00 0.00 5 fwriteIntLSB(int, \_iobuf\*) [5]

-----------------------------------------------

0.00 0.00 2/2 main [1]

[6] 0.0 0.00 0.00 2 SoundFile::readInput(char\*) [6]

-----------------------------------------------

0.00 0.00 1/1 main [1]

[7] 0.0 0.00 0.00 1 writeWaveFileHeader(int, int, int, double, \_iobuf\*) [7]

0.00 0.00 4/5 fwriteIntLSB(int, \_iobuf\*) [5]

0.00 0.00 4/1048580 fwriteShortLSB(short, \_iobuf\*) [4]

-----------------------------------------------