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12 May 2024

ECEN 4233

Take Home Final

<u>Rotation Mode (In test_cordic16.sv, modeSel = 0):</u>

38° (0.663225 rad):

Results (printed to cordic16.out):

y_n (sin) results

Binary	Hex	Decimal (approx)	Decimal (Expected)	Binary (Expected)
0010011101101010	276A	0.6158447265625	0.6156614753256	0010011101100111

Absolute error = $|expected - approximation|$ = 0.0001832512369

Bit accuracy = 81.25%

x_n (cos) results

Binary	Hex	Decimal (approx)	Decimal (Expected)	Binary (Expected)
0011001001101111	326f	0.78802490234375	0.78801075360672	0011001001101111

Absolute error = $|expected - approximation|$ = 0.00001414873703

Bit accuracy = 100%

62° (1.0821 rad):

Results (printed to cordic16.out):

y_n (sin) results

Binary	Hex	Decimal (approx)	Decimal (Expected)	Binary (Expected)
0011100010000011	3883	0.88299560546875	0.88294759285892	0011100010000010

Absolute error = $|expected - approximation|$ = 0.00004801260983

Bit accuracy = 93.75%

x_n (cos) results

Binary	Hex	Decimal (approx)	Decimal (Expected)	Binary (Expected)
0001111000001100	1e0c	0.469482421875	0.469471562785	0001111000001100

Absolute error = $|expected - approximation| = 0.00001085909$

Bit accuracy = 100%

76° (1.32645 rad):

Results (printed to cordic16.out):

y_n (sin) results

Binary	Hex	Decimal (approx)	Decimal (Expected)	Binary (Expected)
0011111000011011	3e1b	0.97039794921875	0.97029572627599	0011111000011001

Absolute error = $|expected - approximation| = 0.00010222294276$

Bit accuracy = 93.75%

x_n (cos) results

Binary	Hex	Decimal	Decimal (Expected)	Binary (Expected)
0000111101111001	0f79	0.24176025390625	0.24192189559966	0000111101111100

Absolute error = $|expected - approximation| = 0.00016164169341$

Bit accuracy = 87.5%

z_n value is the same for each:

Binary	Hex	Decimal	Decimal (Expected)	Binary (Expected)
0000000000000000	0	0	0	0000000000000000

Absolute error = $|expected - approximation| = 0$

Bit accuracy = 100%

Vectoring Mode (In test_cordic16.sv, modeSel = 1):

For $x_0 = x_{in} = 0.5$ and $y_0 = y_{in} = 0.5$ and $z_0 = z_{in} = 0$

Results (printed to cordic16.out):

y_n results

Binary	Hex	Decimal (approx)	Decimal (Expected)	Binary (Expected)
1111111111111110	FFFE	-0.0001220703125	0	0000000000000000

Absolute error = $|expected - approximation| = 0.0001220703125$

Bit accuracy = 6.25% (due to two's complement calculation)

x_n results (expected decimal result using given equation)

Binary	Hex	Decimal (approx)	Decimal (Expected)	Binary (Expected)
0100101010001010	4a8a	1.1646728515625	1.1644353453252	0100101010000110

Absolute error = $|expected - approximation| = 0.0002375062373$

Bit accuracy = 87.5%

z_n, results

Binary	Hex	Decimal	Decimal (Expected)	Binary (Expected)
0000000000000000	0	0	0	0000000000000000

Absolute error = $|expected - approximation| = 0$

Bit accuracy = 100%