CMSC 411 Project Documentation

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Our project implements the CORDIC algorithm for cosh(t), sinh(t), and et in ARM assembly language. The CORDIC algorithm involves a series of rotations of increasingly smaller pre-determined angles, in order to approximate a target angle. In the hyperbolic implementation, those angles are arctanh(0.5i), where i is the rotation number which goes from 1 to the maximum number of rotations. For each rotation, new x and y values are calculated using the formulas:

In the formulas, d indicates the direction of rotation, 1 for clockwise and -1 for counterclockwise. For the hyperbolic implementation of the CORDIC algorithm, the y value starts at 0 and the x value starts at 1.207534. Ordinarily, the x value would start at 1, but the CORDIC algorithm requires the x and y values to be multiplied by a k value at the end, which is approximately 1.207534. To avoid this multiplication, we factor it in at the beginning in the initial x and y values.

When all of the rotations are done, x is approximately the value of cosh(t) and y is approximately the value of sinh(t). The value for et can be found by adding cosh(t) and sinh(t), so the resulting x and y are added together to get et.

The following are some statistics about our program, calculated for different clock speeds:

|  |  |  |  |
| --- | --- | --- | --- |
| **Statistic** | **32kHz clock** | **1MHz clock** | **1GHz clock** |
| CPI |  |  |  |
| Total computer cycles |  |  |  |
| Total processing time |  |  |  |

*Notes:*

5 runs of the program were done on ARMSim, which gave instructions per second numbers for each run.

The 5-run average is:

According to ARMSim there are 574 instructions executed when the program is run.

Sample test data:

|  |  |  |  |
| --- | --- | --- | --- |
| **x** | **cosh(x)** | **sinh(x)** | **ex** |
| 0 | 1.003 | 0.04332 | 1.046 |
| 0.88 | 1.416 | 1 | 2.416 |
| π/4 | 1.327 | 0.870 | 2.198 |
| - π/4 | 1.327 | -0.8704 | 0.4568 |
| -1 | 1.546 | -1.178 | 0.3688 |