

Internship Project Statement

Project Statement

Write RTL for a 3x3 Matrix inversion block using QR decomposition implemented with CORDIC.

CORDIC number of iterations = 15 iterations.

Target Frequency: 150 MHz

Online:

Target Board: Zynq UltraScale+ MPSoC ZCU104 Evaluation Kit

Offline:

ASIC

Project Statement

$$A = \begin{bmatrix} a & b & c \\ d & e & f \\ g & h & i \end{bmatrix}$$

Pivot: a, to be **nulled:** d

1. use a and d as inputs to vectoring CORDIC to obtain a' and θ_1
2. use b and e and θ_1 as input to rotational CORDIC to obtain b' and e'.
3. use c and f and θ_1 as input to rotational CORDIC to obtain c' and f'.
4. Null element d in the R Matrix and update each of a, b, c, e, f.
5. obtain cos and sin of θ_1 to build the \emptyset_1 Matrix.

Pivot: a, to be **nulled:** g

6. use a and g as inputs to vectoring CORDIC to obtain a' and θ_2
7. use b and h and θ_2 as input to rotational CORDIC to obtain b' and h'.
8. use c' and i and θ_2 as input to rotational CORDIC to obtain c' and i'.
9. Null element g in the R Matrix and update each of a, b, c, h, i.
10. obtain cos and sin of θ_2 to build the \emptyset_2 Matrix.

Pivot: e, to be **nulled:** h

11. use e and h as inputs to vectoring CORDIC to obtain e' and

$$\emptyset_1 = \begin{bmatrix} \cos\theta & \sin\theta & 0 \\ -\sin\theta & \cos\theta & 0 \\ 0 & 0 & 1 \end{bmatrix}$$

$$\emptyset_2 = \begin{bmatrix} \cos\theta & \sin\theta & 0 \\ 0 & 1 & 0 \\ -\sin\theta & \cos\theta & 1 \end{bmatrix}$$

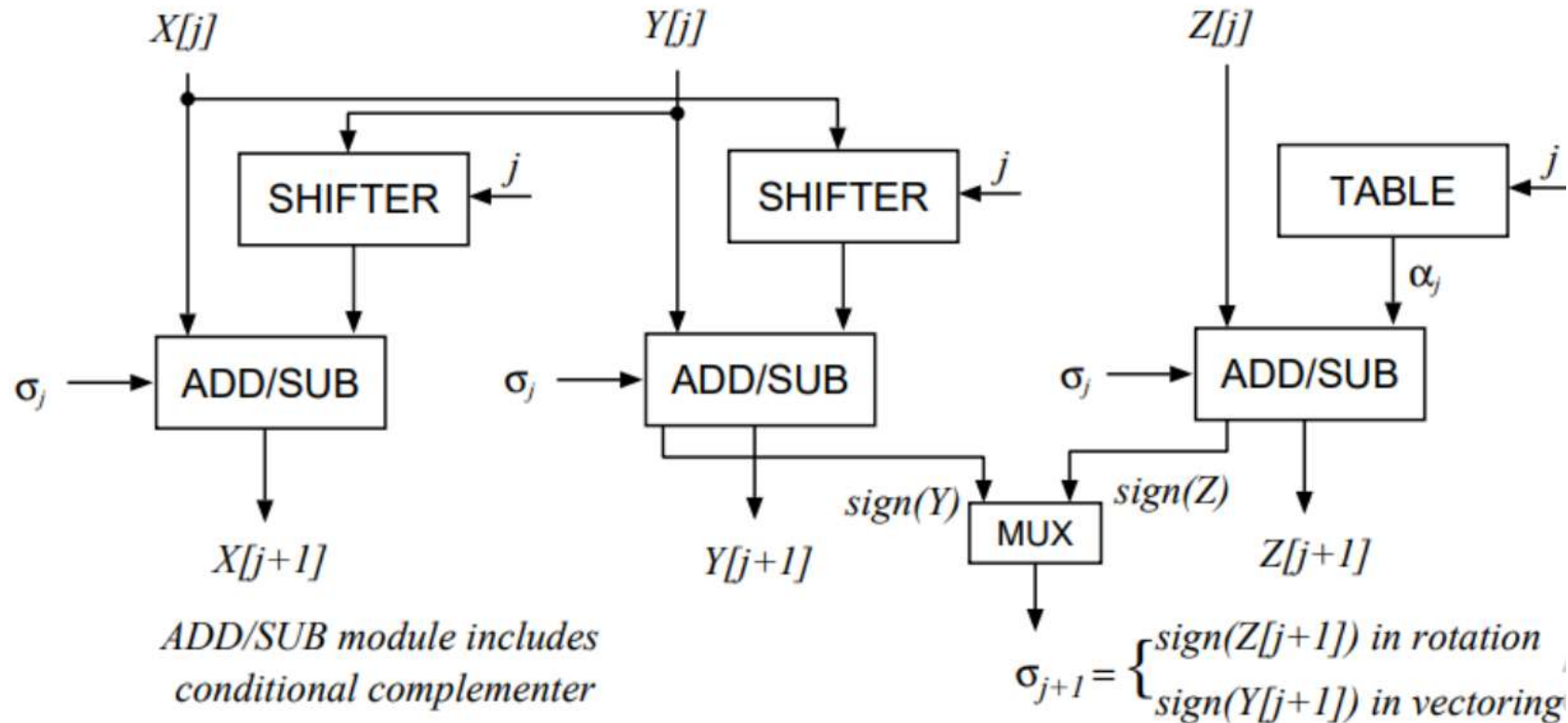
$$\emptyset_3 = \begin{bmatrix} 1 & 0 & 0 \\ 0 & \cos\theta & \sin\theta \\ 0 & -\sin\theta & \cos\theta \end{bmatrix}$$

Q is the matrix multiplication on the 3 previous matrices

$$Q = \emptyset_1 * \emptyset_2 * \emptyset_3$$

Project Statement

- CORDIC Hardware unit



Project Statement

Project Requirements:

- RTL for each submodule
- Testbench for each submodule
- Testbench for the top module
- Timing Diagrams
- Markdown report
- Presentation

Deadline: 3rd Oct. 2024

Timing Diagrams: <https://wavedrom.com/editor.html>

Tutorial: <https://wavedrom.com/tutorial.html>