Semi-Parallel Integer Multiplier in Log2 N Steps with N/2 Multipliers

John E. Harbold

Introduction

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- We introduce a design for semi-parallel multiplier in log2 N step with N/2 multipliers. In response to C.H. Ting's Matrix Multiplication in a Massively Parallel Processor, he confessed to not being able to come up with a parallel multiplier. This was in response to computing the determinant of such a matrix. While hanging out in the Hilton Sports Book in Las Vegas, I was sitting listening to a slot machine enticing me to play “Diamond Ridge”, I then figured out how to do a semi-parallel multiplier.

Serial Multiplier

Serial Multiplier

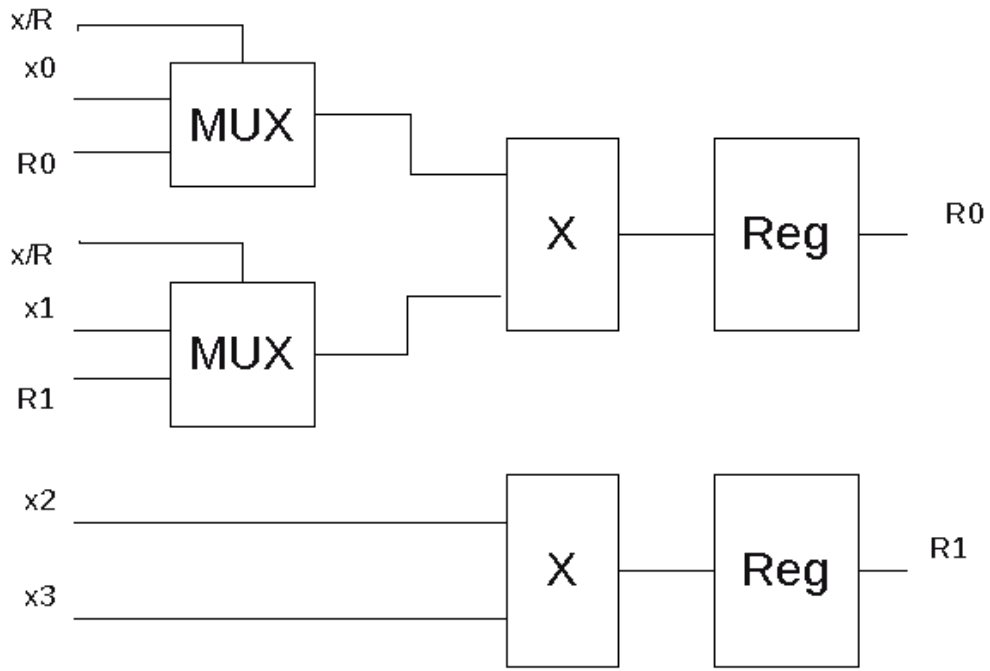
- Serial Multiplier: Multiplies N factors in N-1 steps.
- Implemented as one multiplier with one MUX and one register.

Semi-Parallel Multiplier

Semi-Parallel Multiplier

- Initially, with N factors, N/2 pairs of factors can be multiplied in parallel.
- By judicious use of MUXs and storage registers, the N/2 multipliers can be re-used. This will lead to log2 N steps to final product.

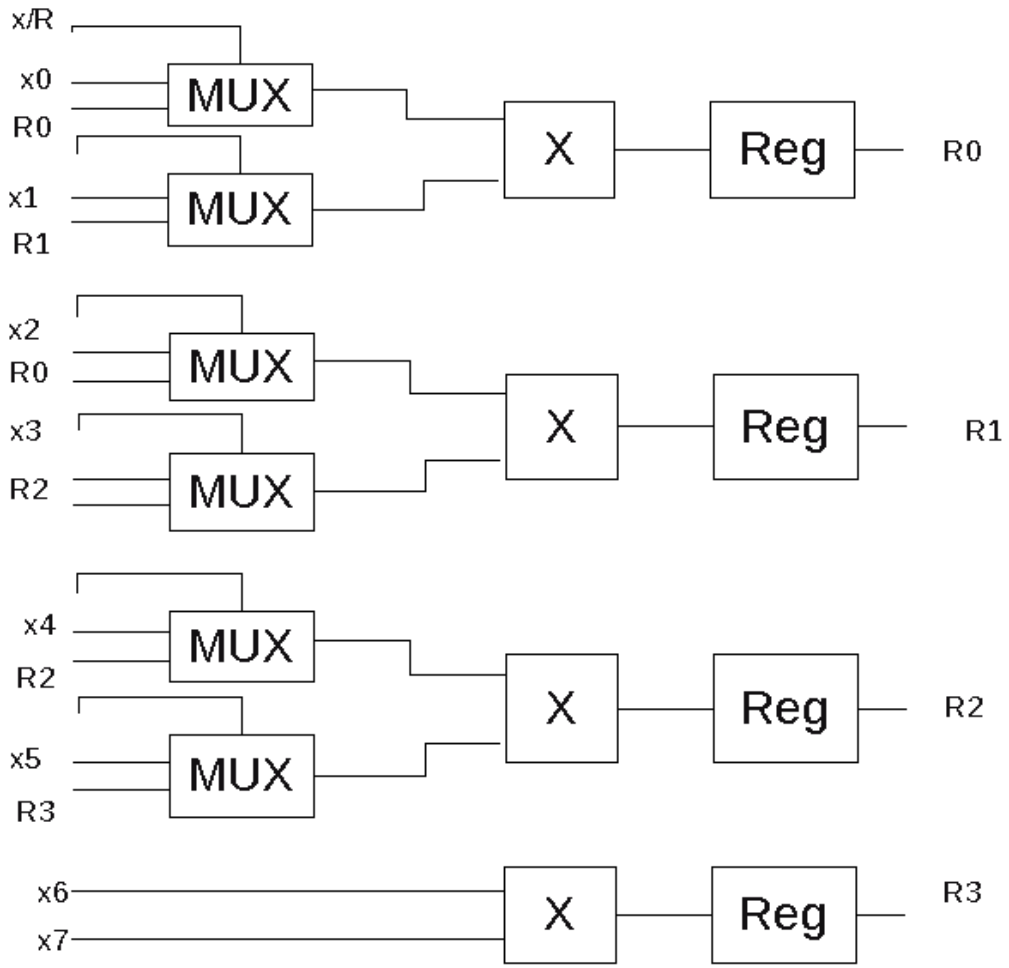
N=4 Semi-Parallel Multiplier



N=4 Multiplier Enables

- Step 0: R0, R1
- Step 1: R0
- Answer is in R0

N=8 Multiplier



N=8 Multiplier Enables

- Step 1: R0, R1, R2, R3
- Step 2: R0. R2
- Step 3: R2
- Answer is in R2

TODO

- Generalize the product results to the MUXs
- Find FPGAs that have the constituent part