

# Sequential Arithmetic

ELEC 311

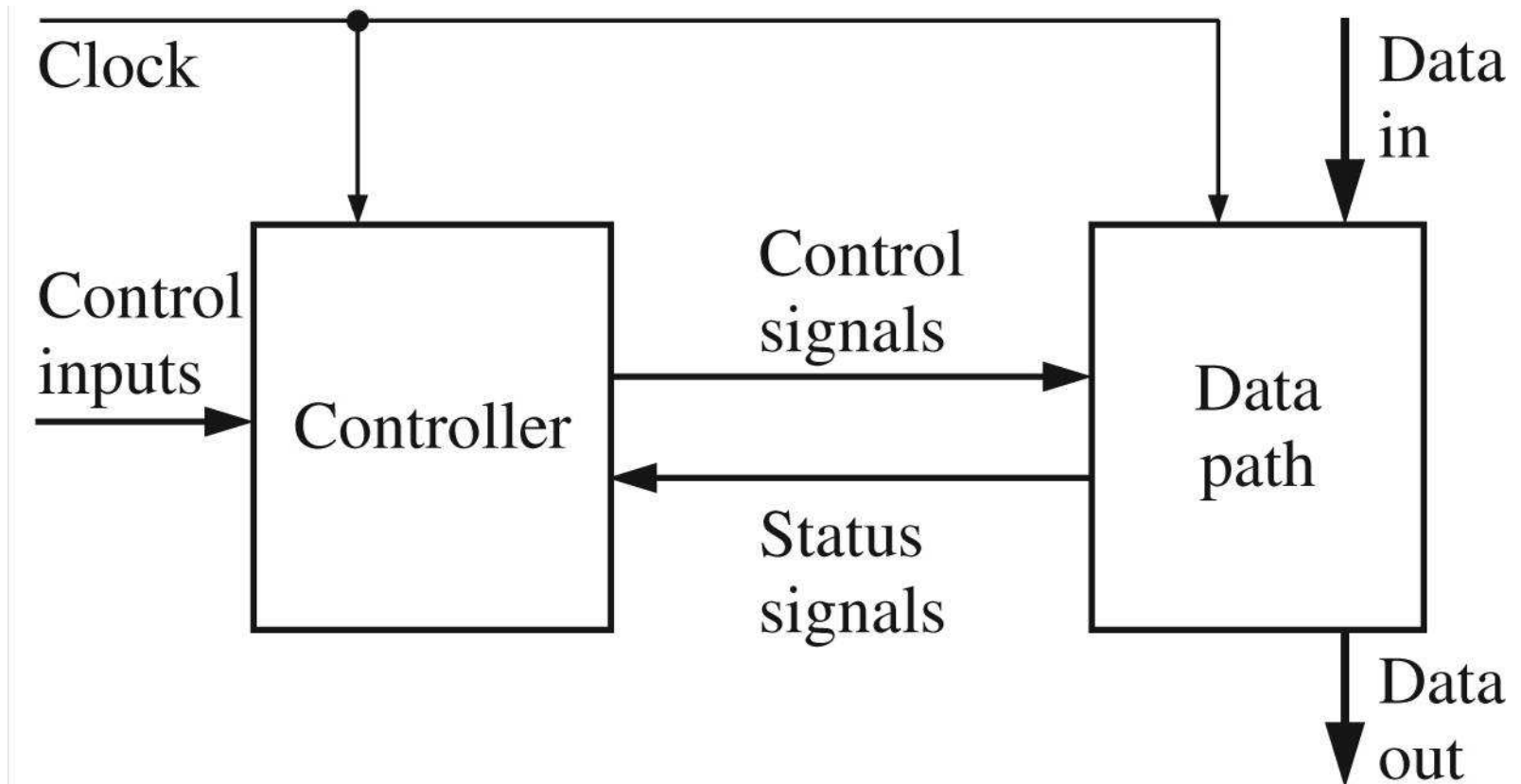
Digital Logic and Circuits

Dr. Ron Hayne

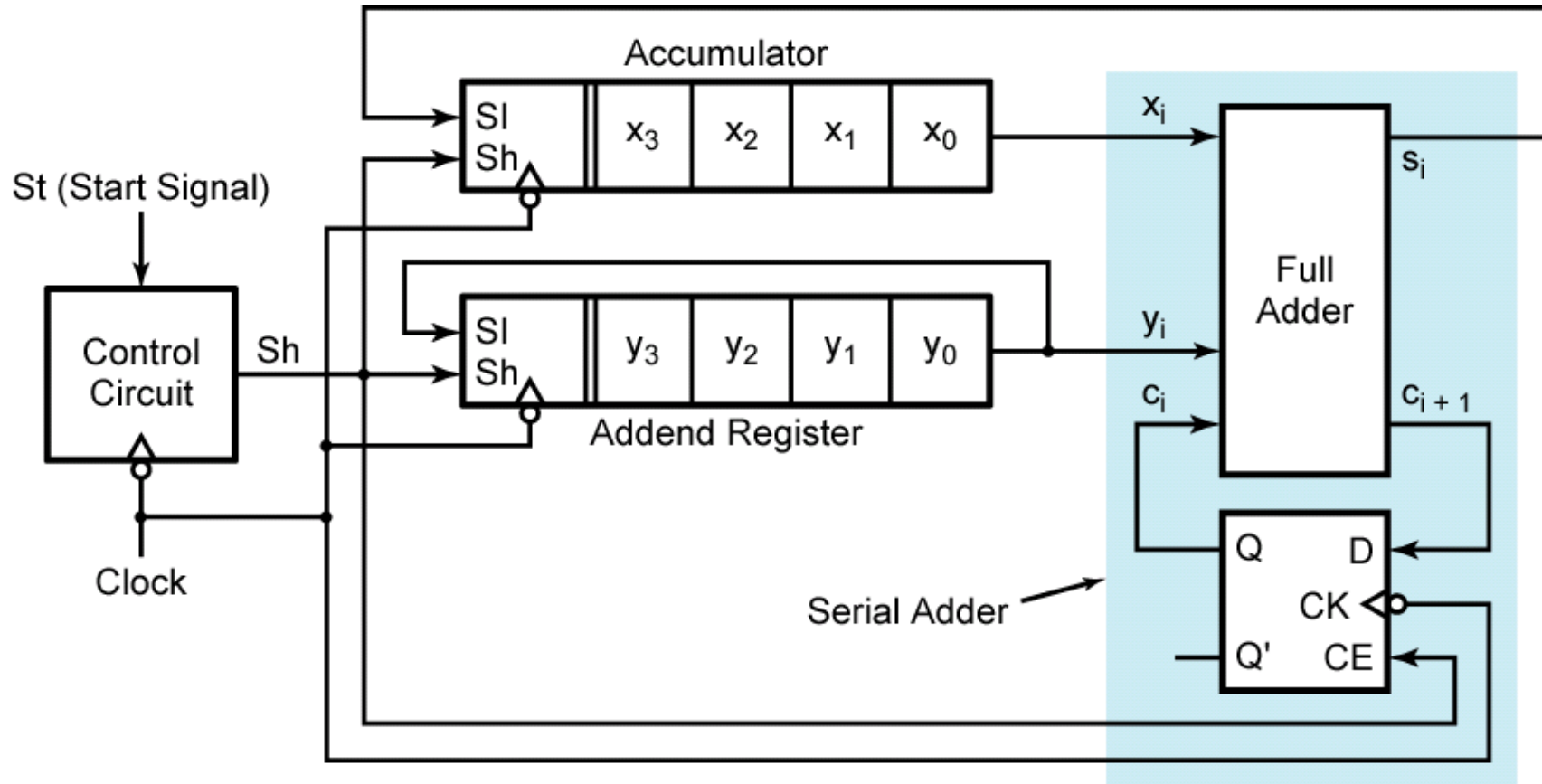
*Images Courtesy of Cengage Learning*



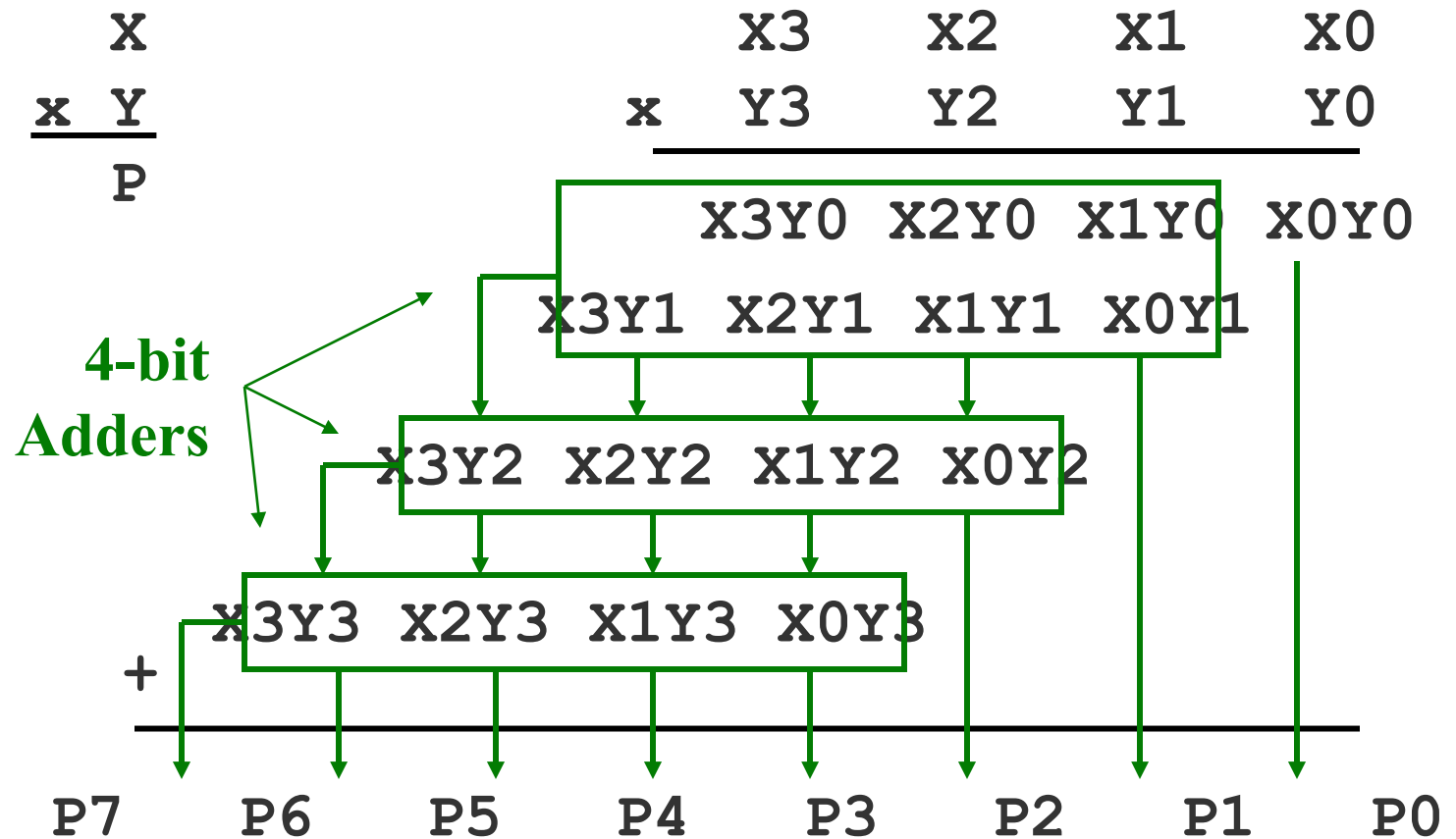
# Data Path and Controller



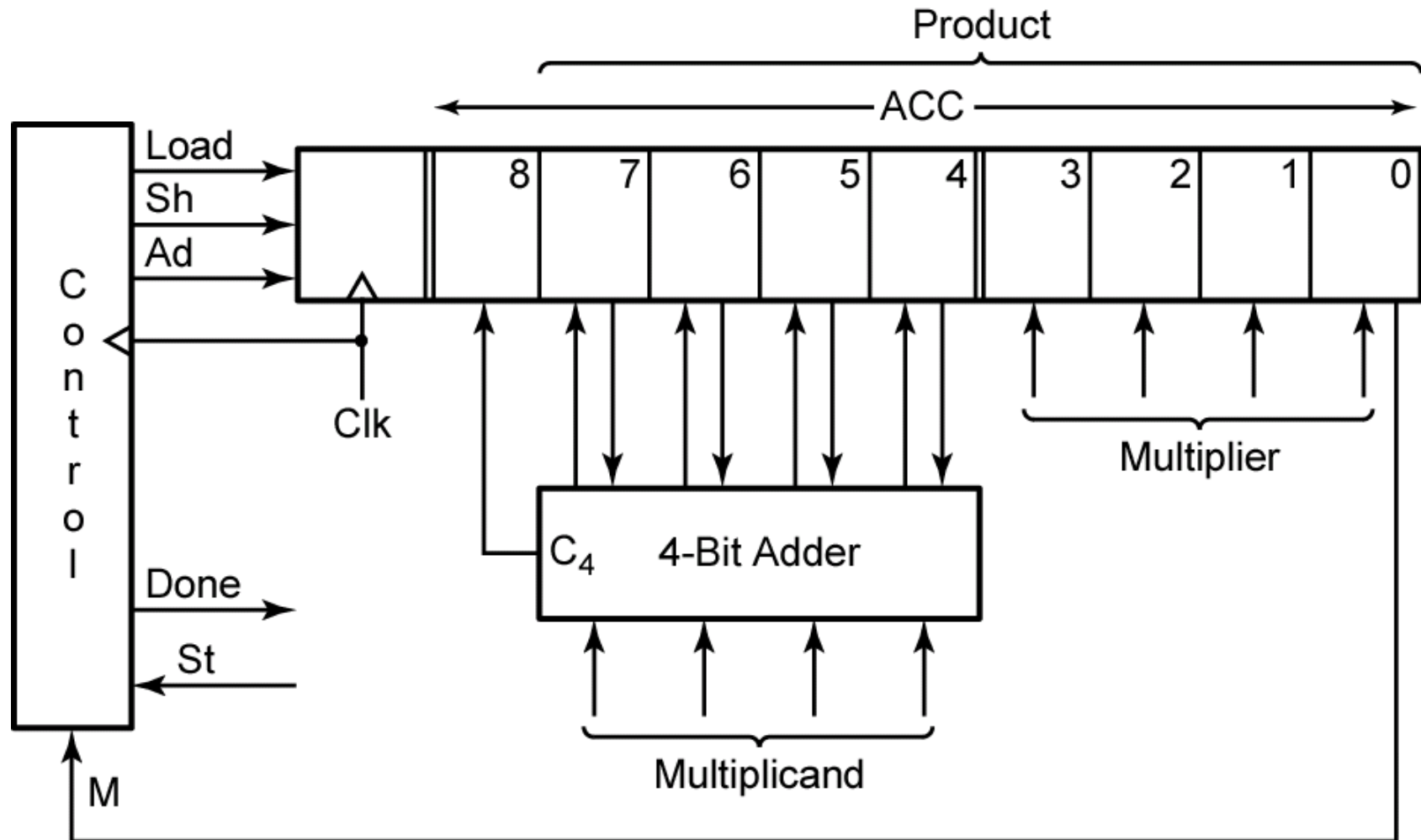
# Serial Adder with Accumulator



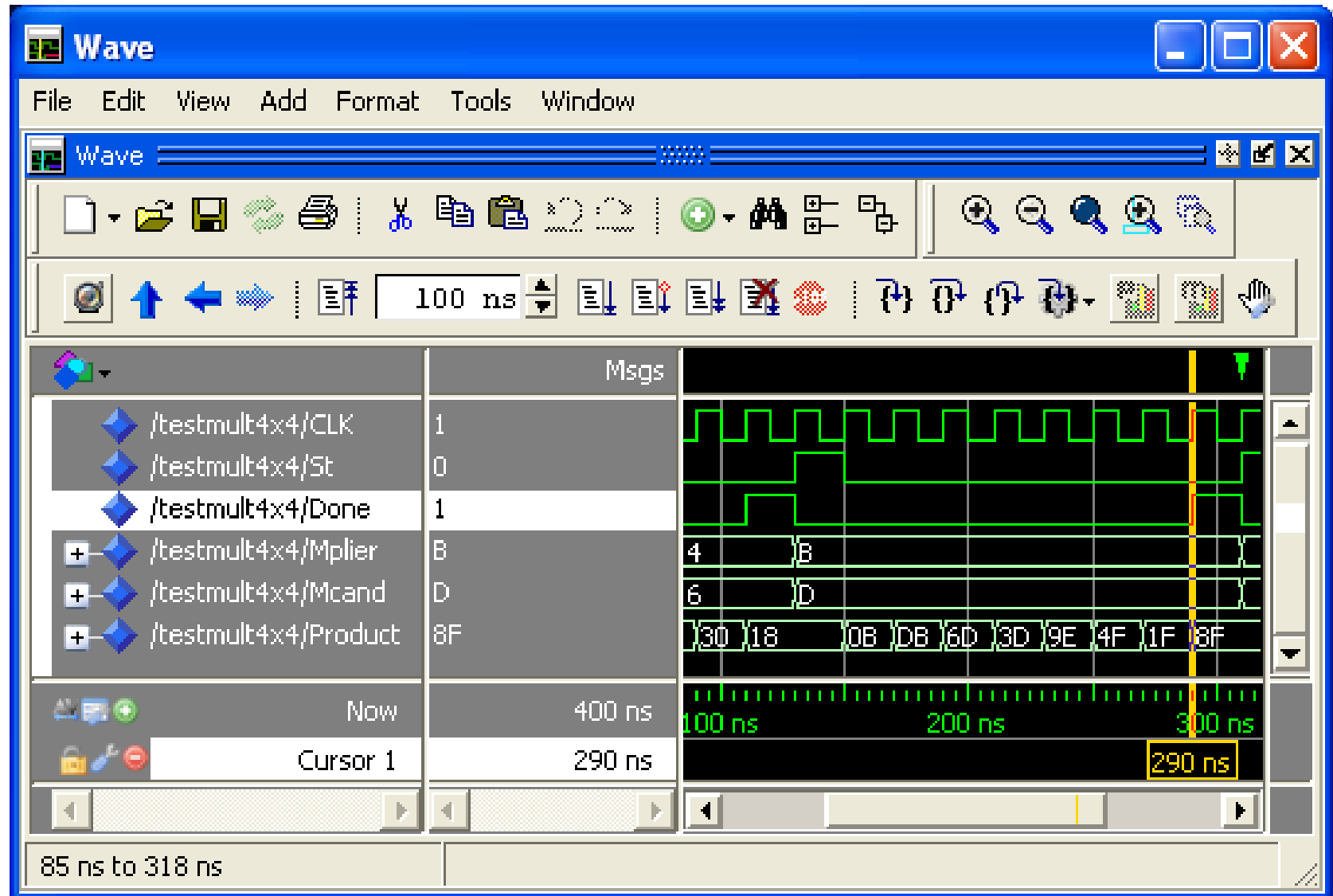
# Combinational Multiplier



# Parallel Binary Multiplier



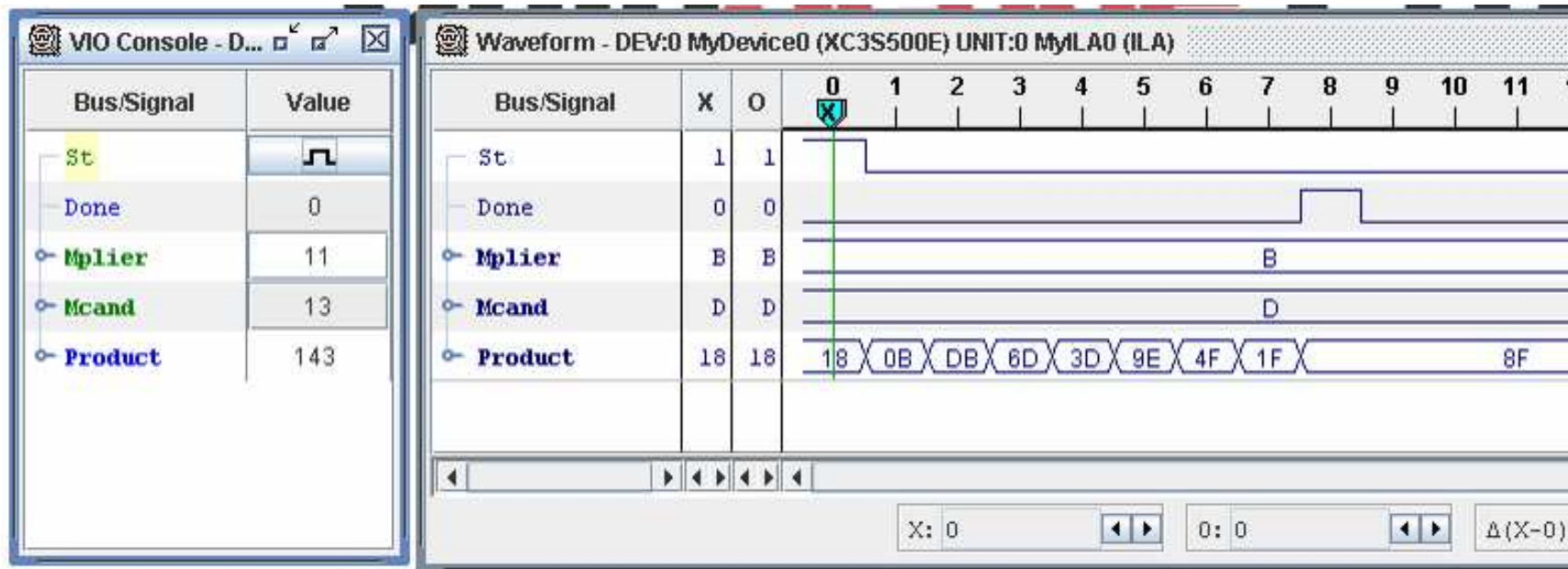
# ModelSim Simulation



# FPGA Implementation

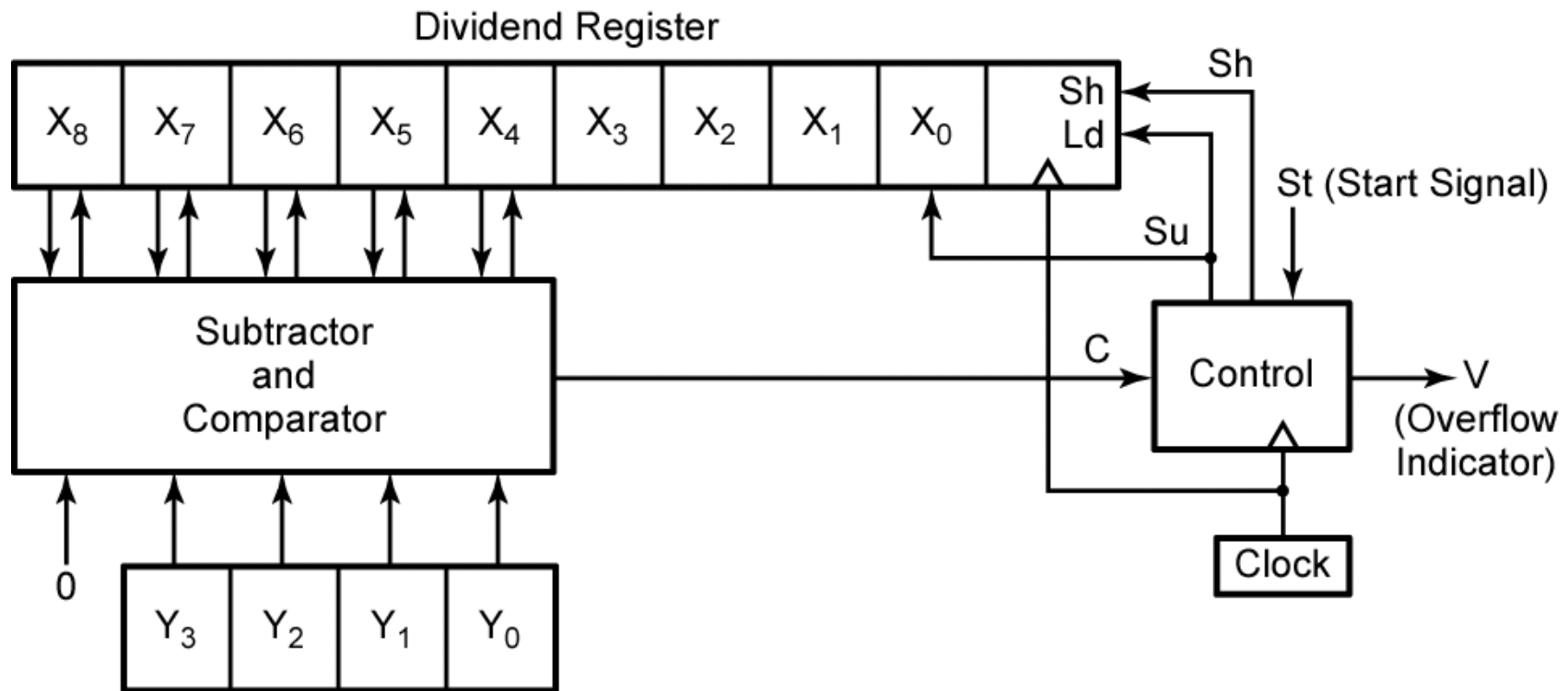
- ◆ Xilinx Spartan3e
  - 500K System Gates
  - 50 MHz Clock
- ◆ ChipScope Pro
  - Virtual Input/Output Core (VIO)
  - Integrated Logic Analyzer (ILA)
- ◆ Real-Time Verification
  - Captures On-chip Signals
  - Off-chip Analysis via JTAG Programming Cable

# ChipScope Pro Analyzer





# Binary Divider



# Summary

- ◆ Serial Adder
- ◆ Combinational Multiplier
- ◆ Parallel Multiplier
  - ModelSim Simulation
  - FPGA Implementation
- ◆ Binary Divider