Field Programmable Analog Array

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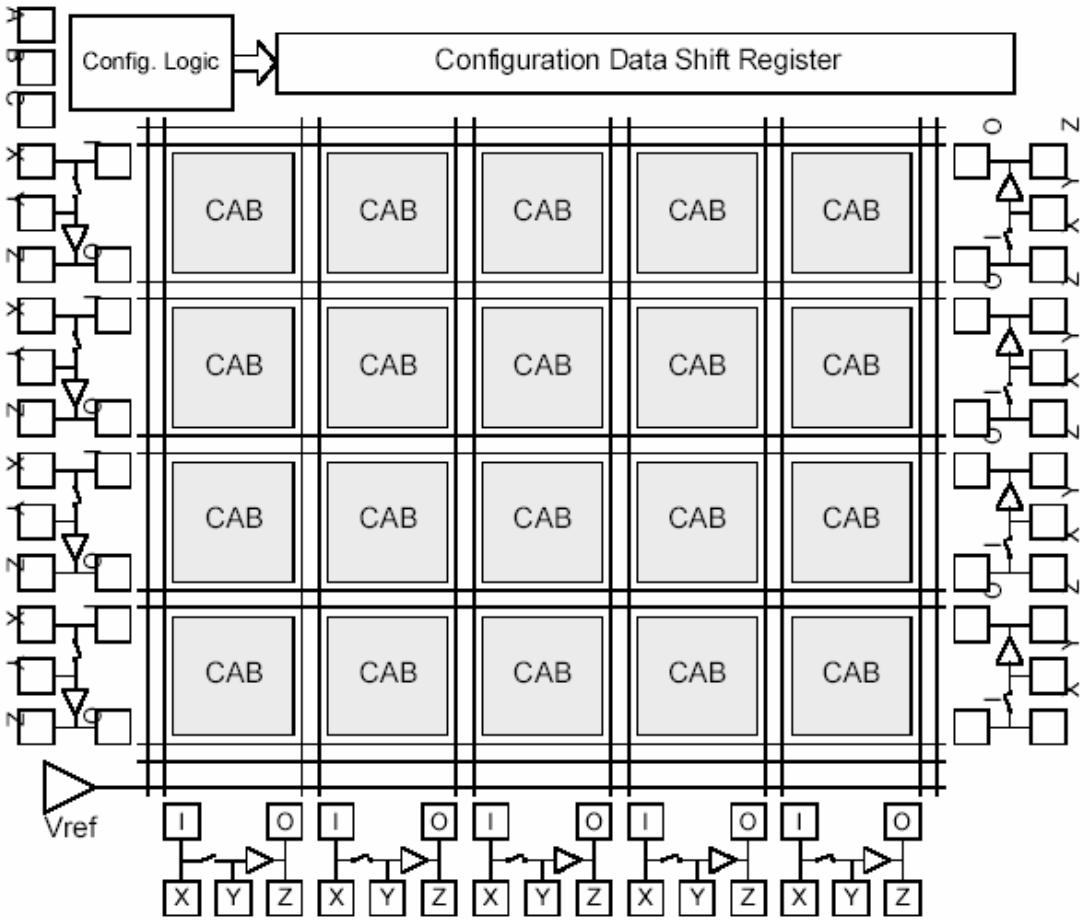
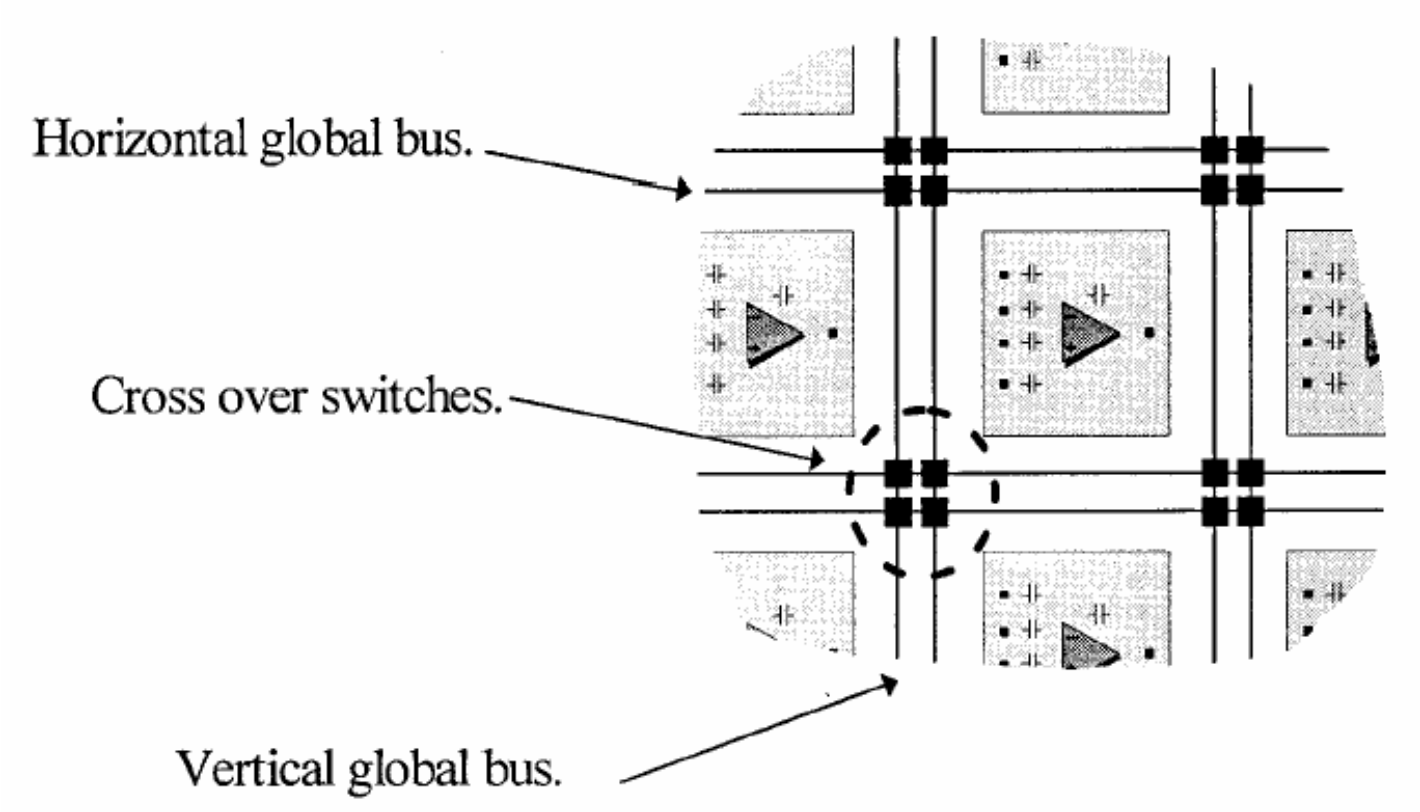
Why Programmable Analog?

- Faster Prototyping
- Faster Time-to-Market
- Shorter Design Cycles
- Design integration
- Improved component matching

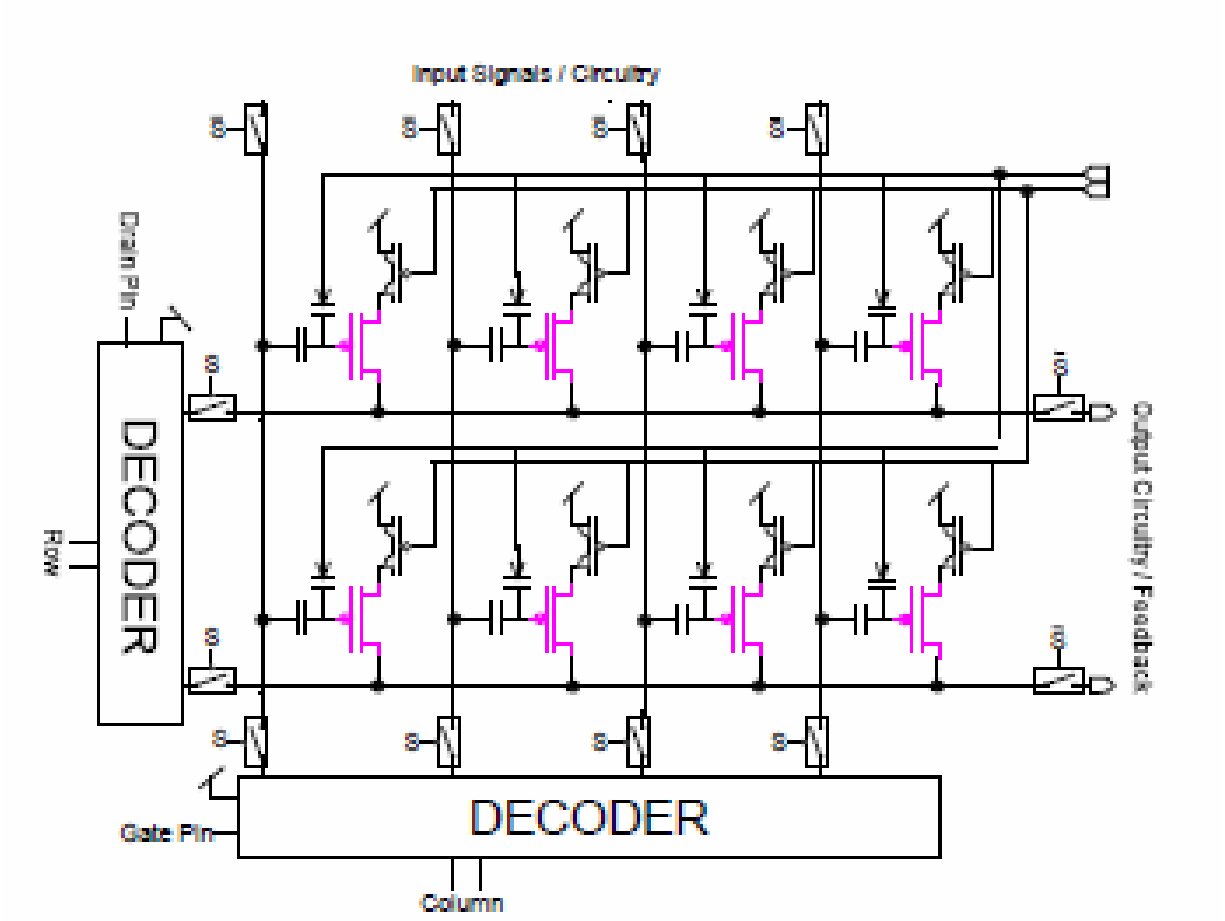
Architecture of FPAA



Routing Architecture



Switching Matrix



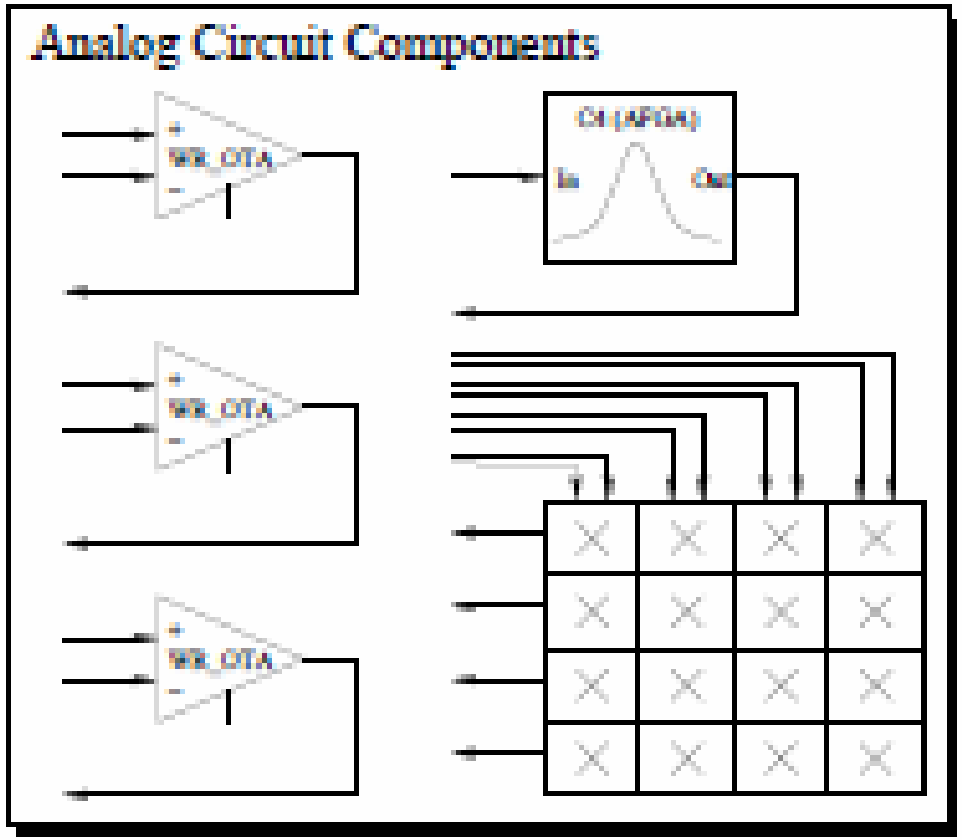
CAB Implementation

- Continuous Time vs. Discrete Time

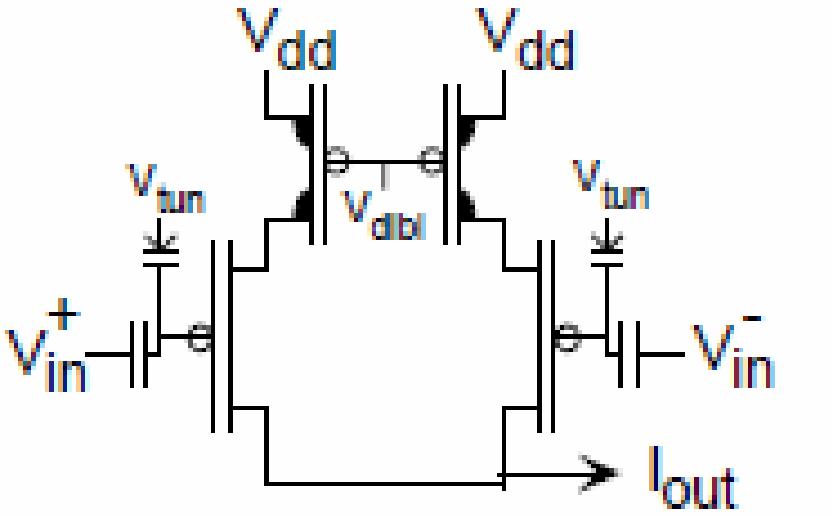
Discrete Time

- Switched Capacitor Design (Current)
- Pulse Based Design (Under Research)

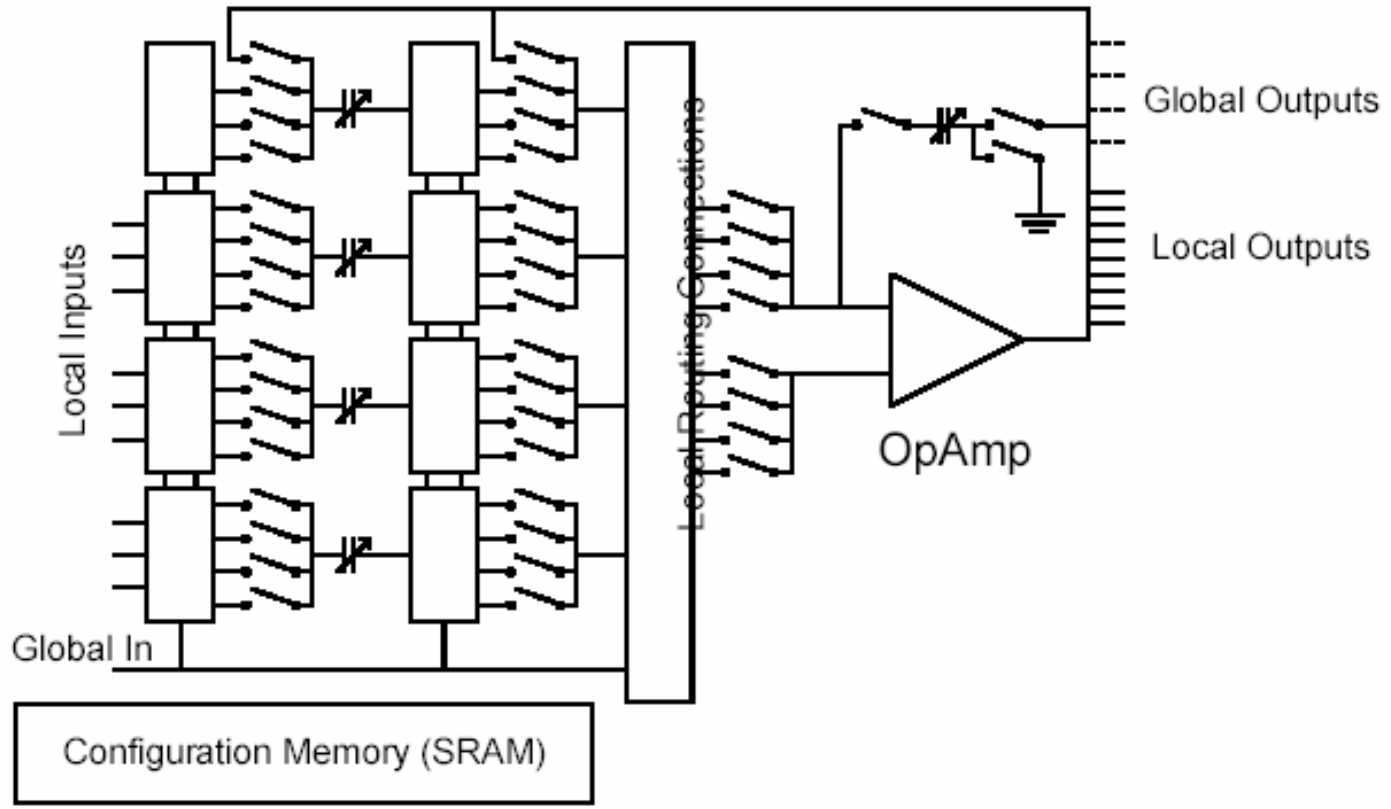
Architecture of Configurable Analog Block



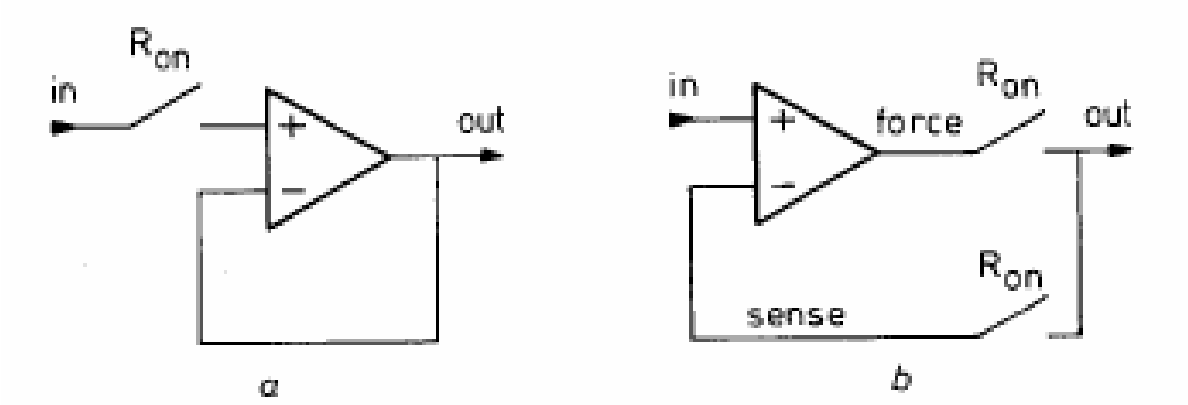
Multiplication of an input by a constant



Switched Capacitor based design



Switches for input and output

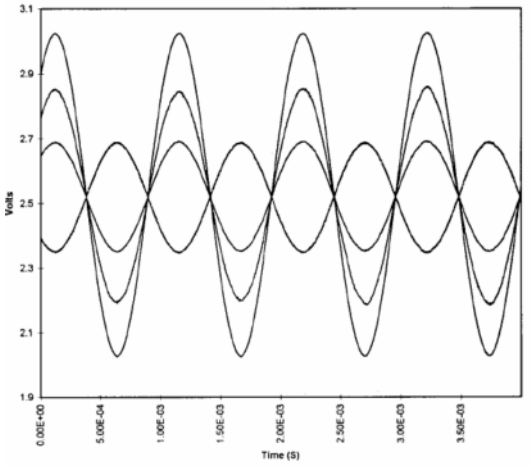


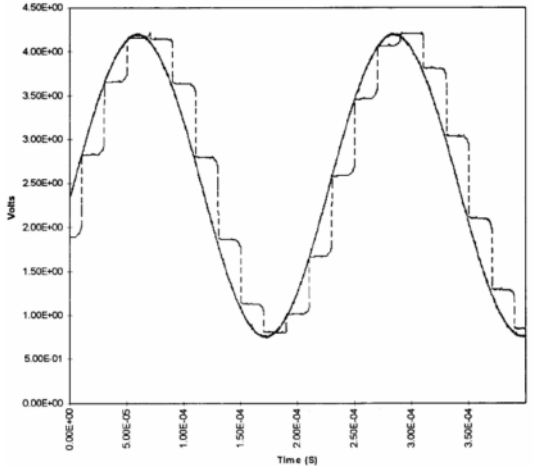
Benefits of SC Design

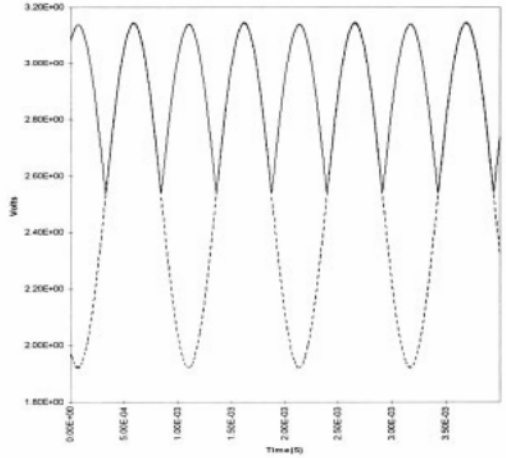
- Design of SC circuits quite mature
- Switches already present in FPAA
- Allows for better accuracy than RC
  - 0.05% - 0.2% vs. 10% - 30%

Performance of SC Design

- Currently limited to 1MHz
- Versatile design possibilities







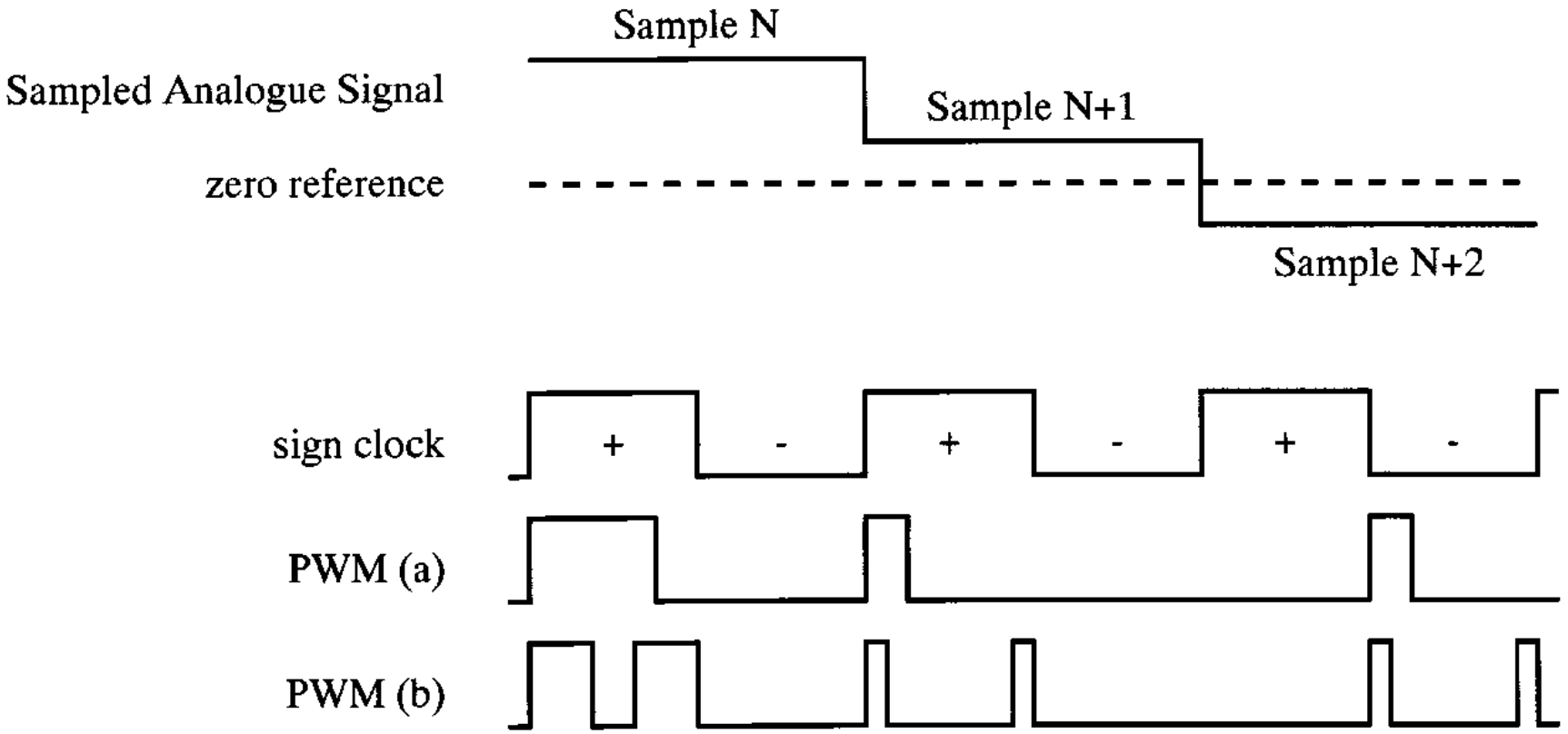
Problems with SC Design

- Limitations on switching frequency
  - Require non-overlapping clocks
- Voltage used to represent signal
  - Signal still susceptible to noise
- Increased mixed signal noise

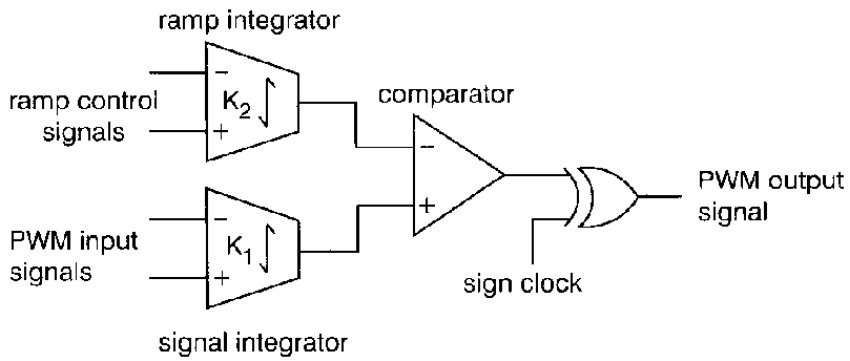
Pulse based design of CAB

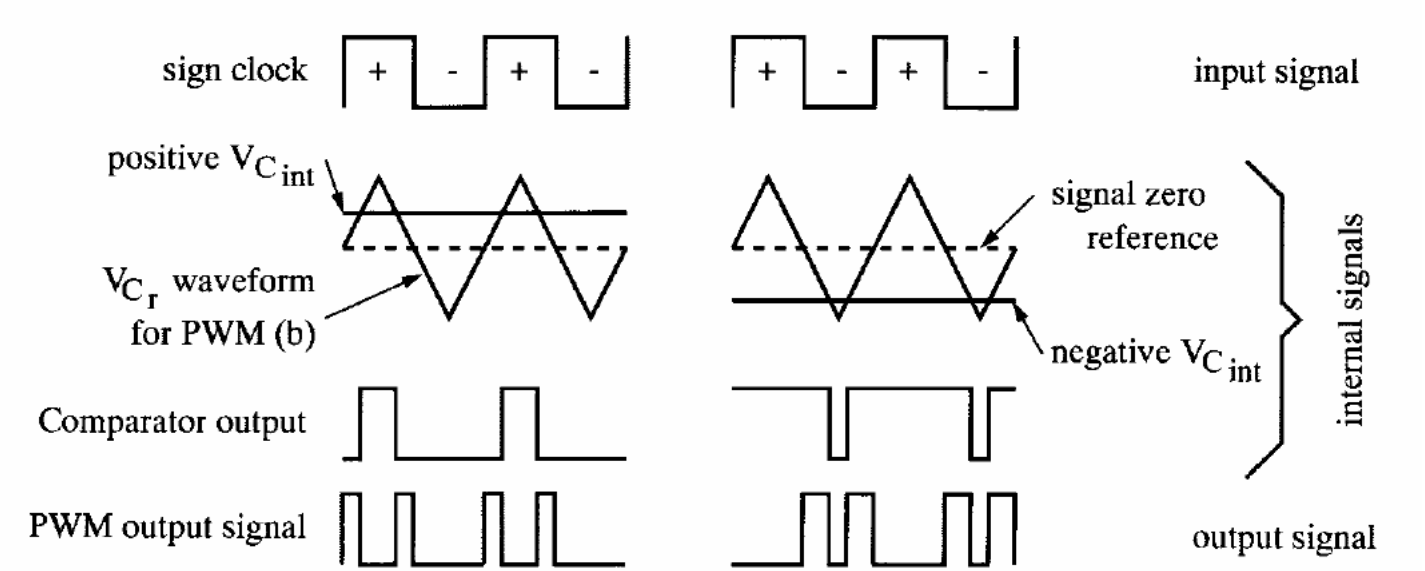
- Uses time to represent transmitted signal in the form of PWM
- Uses of digital signals levels
  - Noise immunity
- Relatively new area of research
  - Limited functionality
  - Complete design not yet available

Two forms of PWM signals

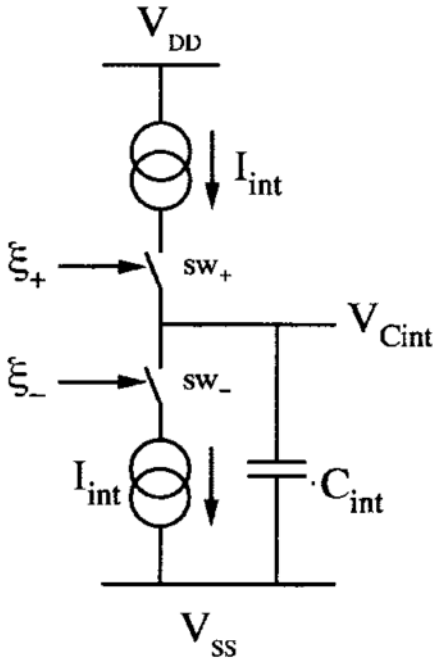


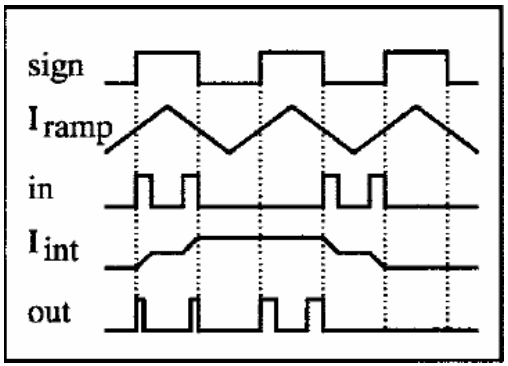
Pulse Signals



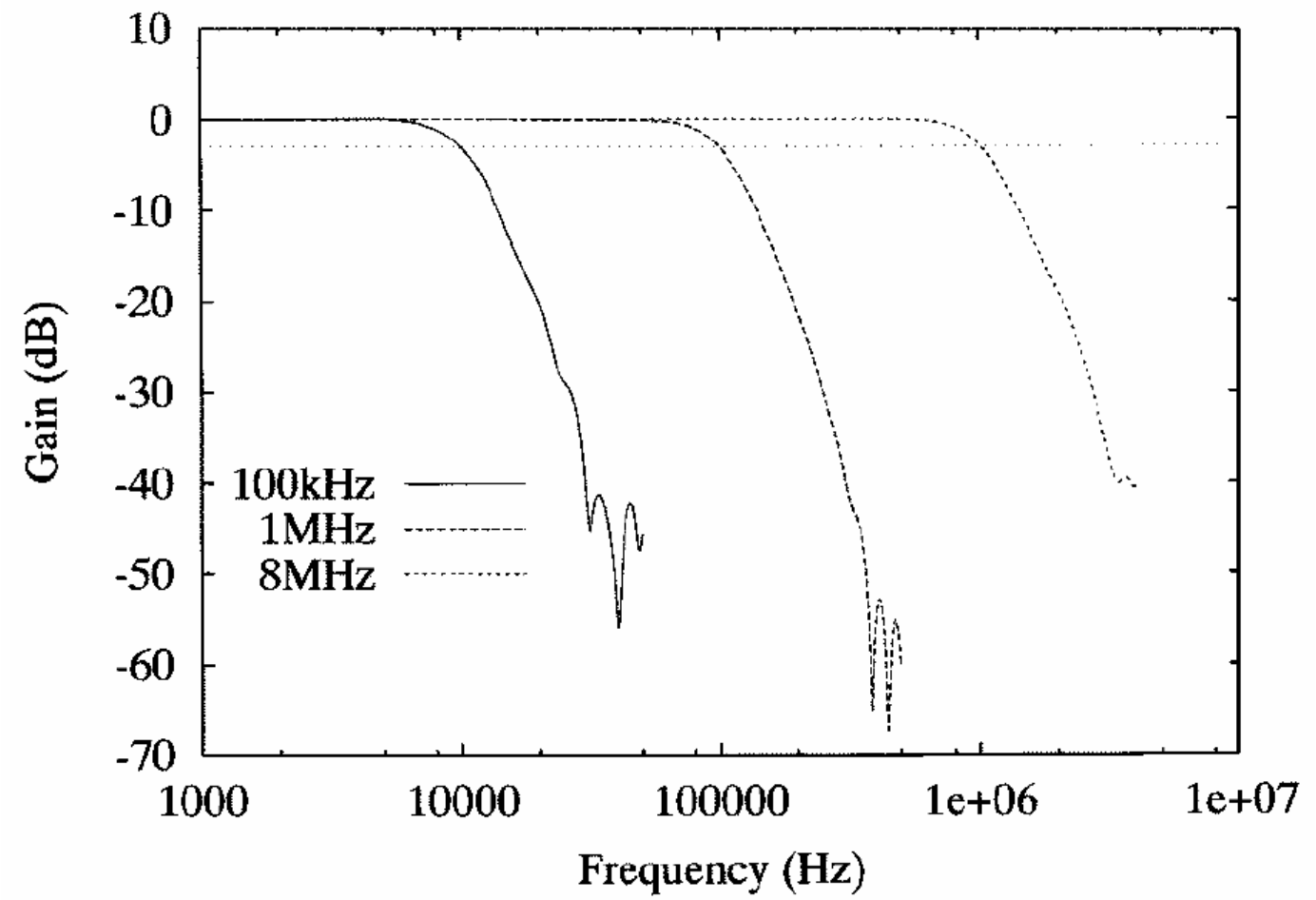


Pulse based Integrator





Pulse based Performance



Future of FPAAs

- SC designs will dominate commercially
  - Improvements must be acheived
- FPAAs may lead to FPMAs
  - Natural evolution of mixed-signal design
- Question of viability must be answered
  - FPAAs vs. FPGA comparison
  - 8MHz vs. +1Gbps

Questions?