Actively Stabilized Gimbal Sensor Platform

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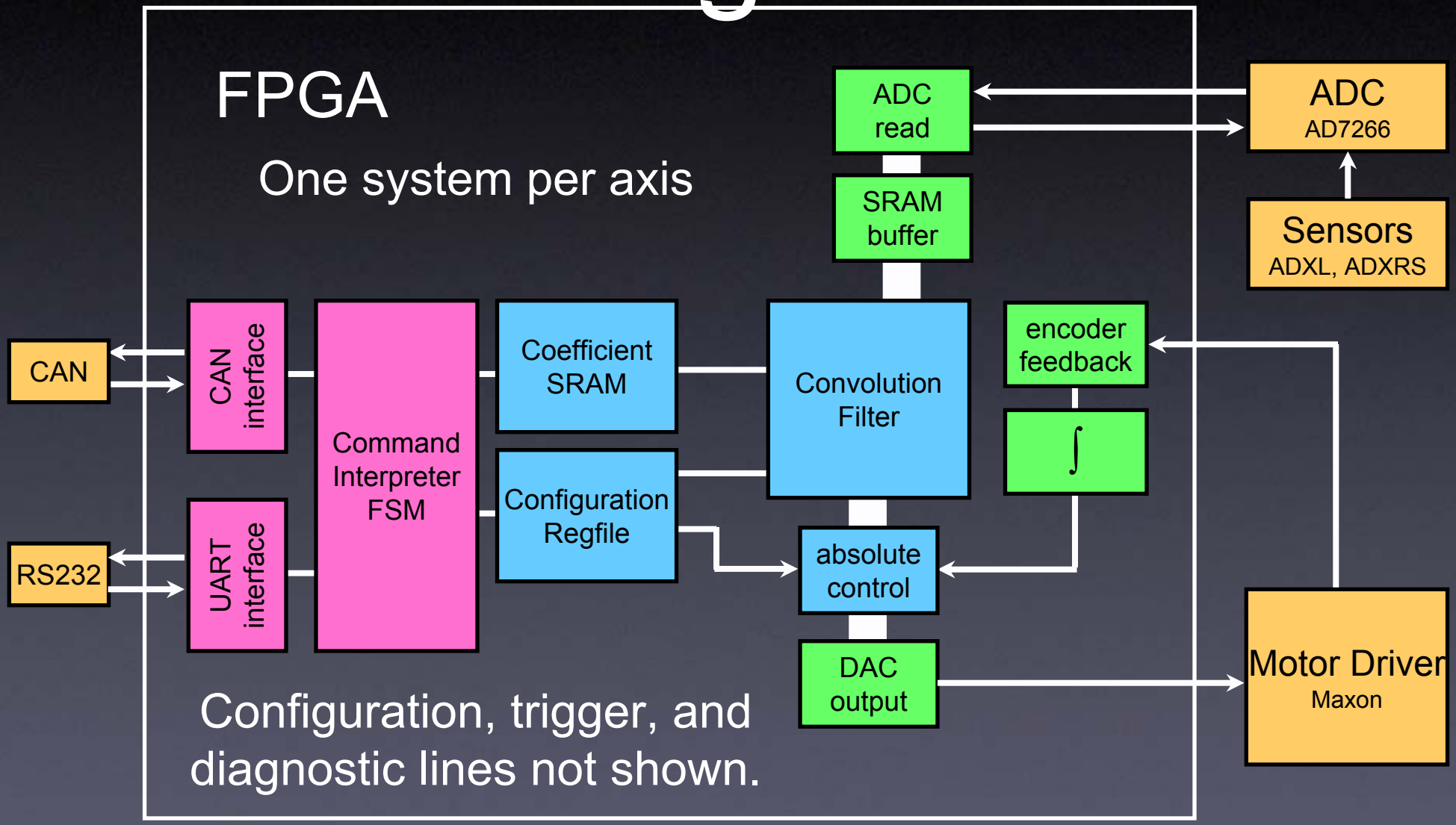
- DARPA Grand Challenge 2005
- Improves sensor data quality
- Leverages power of configurable logic with low-latency control loops

Sensors and Motors

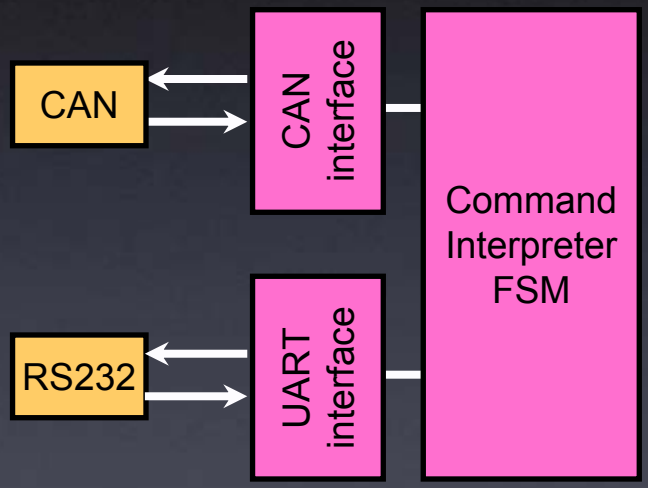
- Maxon brushless motors with 74:1 gearing
- Maxon controller/amplifier
- Analog Devices ADXL accelerometers and ADXRS gyroscopes
- 12-bit Serial ADCs, DACs

Overall Block Diagram



Control Interfaces

- Controller Area Network
  - SJA1000 CAN core
- RS232 Backup Interface
  - 16550 UART core
- Open-source modules
- MAX232 and SN65HVD251 transceivers



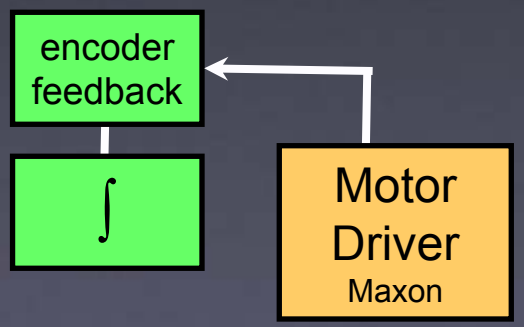
Command Interpreter

- Allows host to modify operation of system
- Stores and parses commands from CAN and RS232 interfaces
- Used for setup, configuration and debugging
- Directly reads and writes to a bank of registers

Input Blocks

- Serial ADCs
  - ADXL accelerometers
  - ADXRS rate gyroscopes
  - Buffered to allow variable sampling rate

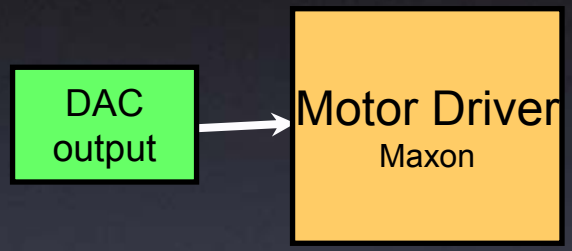
- Motor encoder
  - Gives us motor position
  - Compare to desired position



- Data also fed back to register file

Motor Control Output

- DAC outputs voltage to Maxon controller
  - Value calculated from filter and absolute offset
  - Controls current or velocity

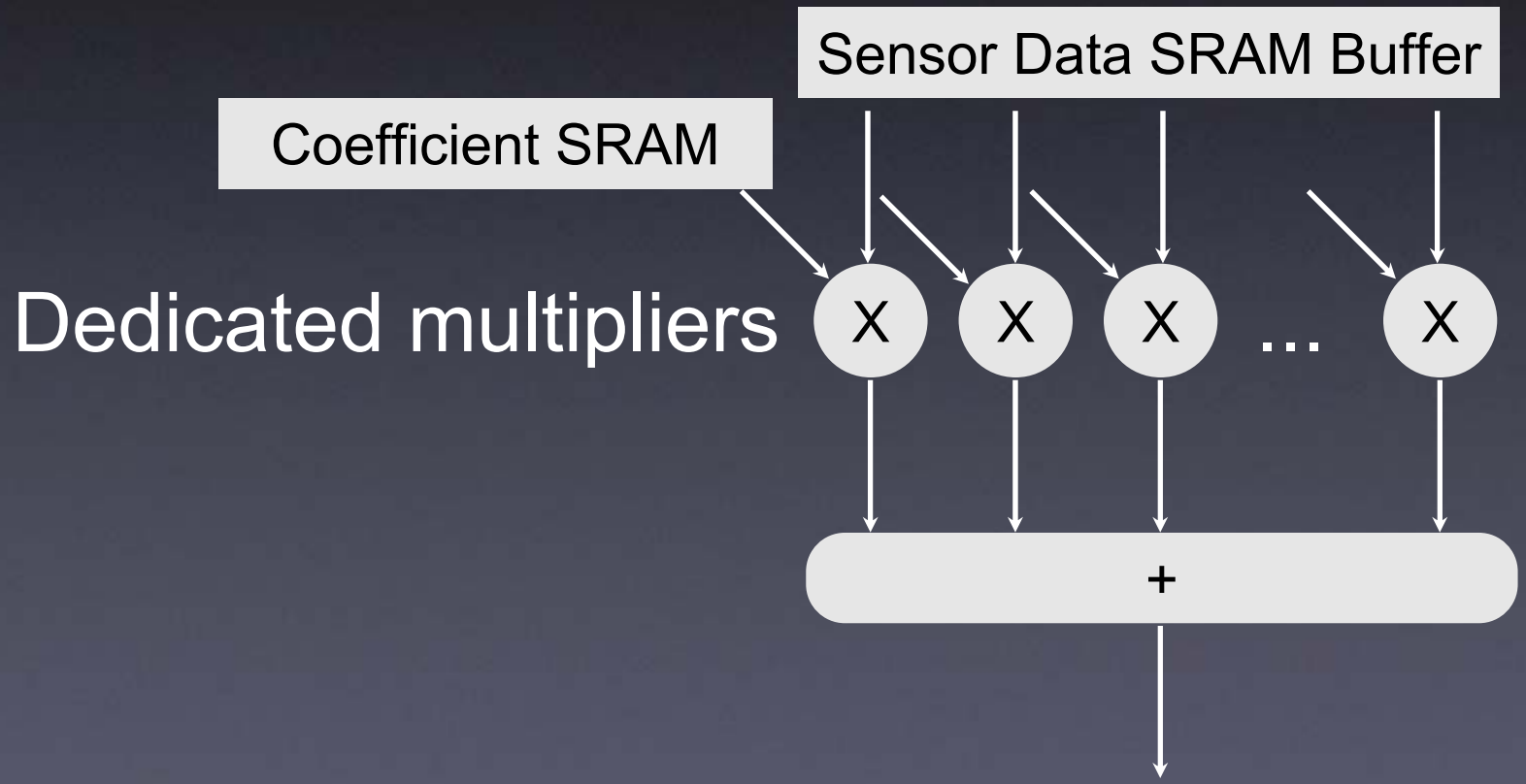


Config Register File

- Collection of registers
- Allows dynamic reconfiguration:
  - Sensors/ADCs in use
  - FSM timing frequencies
  - Generic parameters
- Diagnostic feedback:
  - Motor position, sensor values

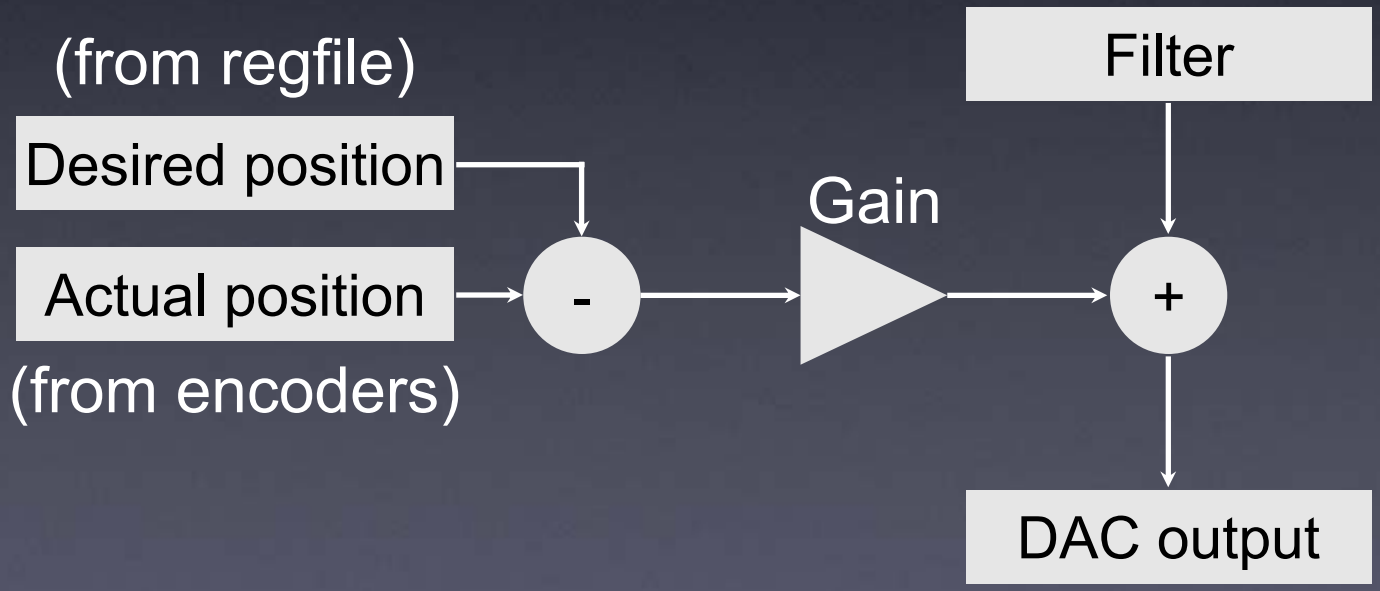
Convolution Filter

- Like Lab 3, but parallelized and high-resolution
- Parameterized for arbitrary bus width, arbitrary number of multipliers



Absolute Control

- Provides ability to override stabilization with high-level position control



Timeline

- 4/29 - UART, basic commands, ADC input
- 5/2 - hardware, CAN, basic filter, motor control, encoder feedback
- 5/7 - absolute control, command interpreter
- 5/10 - debugging finished!