EE 233 Experiment 3

- **Digital controller implementation.**
  - **use PIC16F88 as the controller.**
  - **use the internal 10-bit A/D converter.**
  - **use 10 digital output bits and R-2R ladder to do D/A conversion.**

- **Difference equations similar to experiments 1 and 2 will be used. Different coefficients may be specified.**

EE 233 Experiment 3

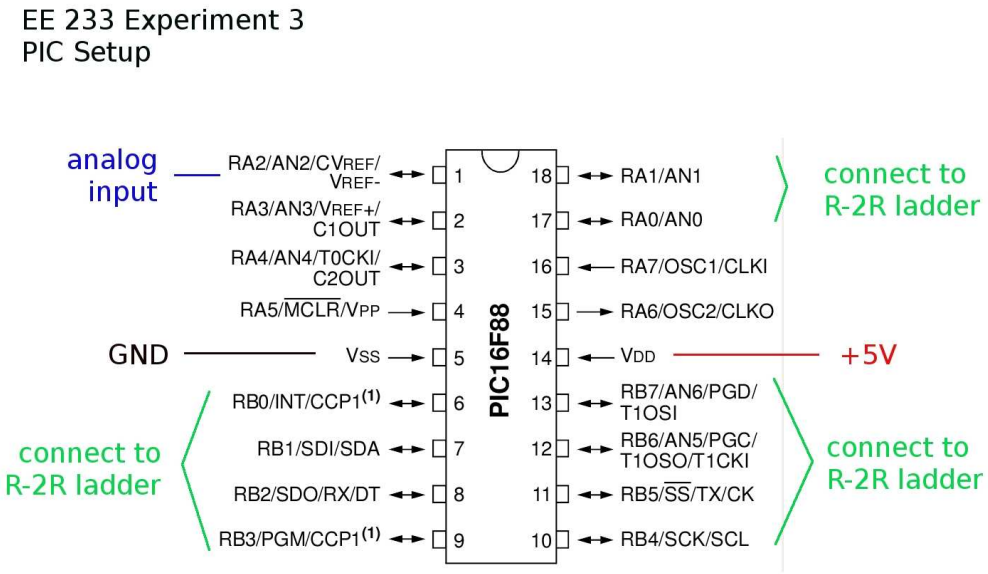
- **Project details.**
  - $e(k)$ is the input voltage.
  - $y(k)$ is the output voltage.
  - assume input and output voltage range is 0 to 5 V.
  - the voltages are quantized into unsigned 10-bit values.

$$0V \leftrightarrow \text{0x0000}$$
$$5V \leftrightarrow \text{0x03FF}$$

  - PIC RA2/AN2 must be used as analog input.
  - PIC PA[1:0] and PB[7:0] are to be used with an R-2R ladder for analog output functionality.
  - sampling rate is 1 kHz.

EE 233 Experiment 3

- **Build the PIC16F88 setup and program the PIC16F88 to implement the sequential solution to a difference equation.**



EE 233 Experiment 3

- Build an appropriate R-2R ladder for D/A conversion.

- PIC16F88s may be borrowed.

- You will need
  - a breadboard to assemble your circuit.
  - resistors for your R-2R ladder.
  - battery to power your circuit.

EE 233 Experiment 3

- General program flow.
  - initialize the PIC. see sample code.
  - A/D operation. sample analog input. see sample code.
  - implement filter operation : multiply and add operations.
  - D/A operation. use digital outputs. see sample code.
  - repeat : loopback to A/D operation.

- Write the program in assembly. Compile (assemble) with MPASM or gpasm. A PIC programmer will be made available to the class.

EE 233 Experiment 3

- No internal floating-point number representation and no internal floating-point operations.
  - PIC16F88 only has 8-bit operations.
  - implement 16-bit or 32-bit operations to get reasonable accuracy for your computations.

- Sample code has
  - initialization for 4 MHz internal clock, RA2/AN2 analog input, and PA[1:0] and PB[0:7] digital outputs.
  - routines for A/D and D/A operation.

EE 233 Experiment 3

- **Deadline is on 24 September 2009. You work will be tested in the lab.**