TI-RSLK MAX

Texas Instruments Robotics System Learning Kit

Texas Instruments

Module 15

Quiz: Data Acquisition Systems

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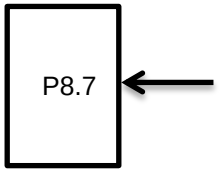
Q1 ADC sampling, interrupts

Write C code that samples ADC channel 19, P8.6. In particular implement these two functions. Use 14-bit mode, busy-wait, 3.3V reference.

void ADC0_InitSWTriggerCh19(void);

uint32_t ADC_In19(void);



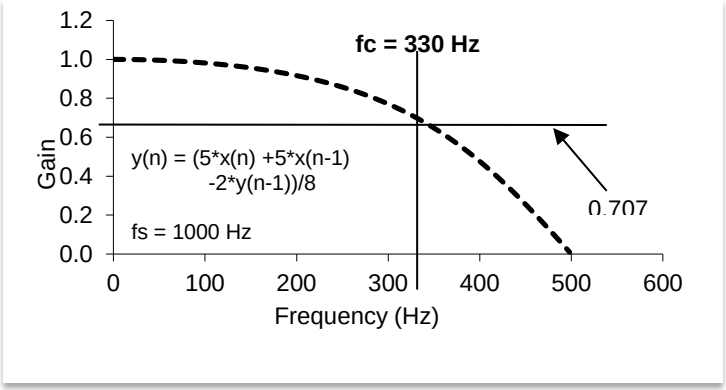
Write C code that implements a mailbox, sampling P8.6 at 1000 Hz using SysTick interrupts. Show the initialization of the ADC (call **ADC0_InitSWTriggerCh19**), initialization of the SysTick timer (assuming 48 MHz bus clock), and the SysTick ISR (call **ADC_In19**) that sends ADC samples to the mailbox every 1ms. You do not have to show the main program that reads the mail and clears the semaphore. Just show the main program that initializes sampling and enables interrupts. Include this digital low pass filter.

y(n) = (5*x(n) +5*x(n-1)-2*y(n-1))/8

where

x(n) is the current sample, e.g., **x[0] = ADC_In19();**
x(n-1) is the previous sample, **x[1]**
y(n) is the current filter output, **y[0]**
y(n-1) is the previous filter output, **y[1]**

If the data are sampled at fs=1000 Hz, this filter is a low pass.



Q2 Nyquist Theorem

In 32 words or less, give a definition of the Nyquist Theorem. Explain what it means if the sampling rate is 1000 Hz.

Q3 Aliasing

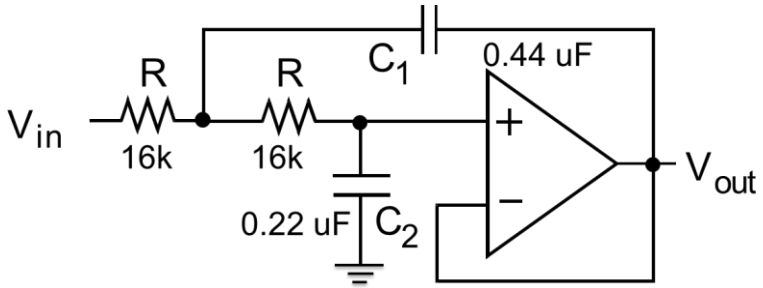
In 32 words or less, give a definition of aliasing. Explain what it means if the sampling rate is 1000 Hz.

Q4 Central Limit Theorem

In 32 words or less, give a definition of the Central Limit Theorem. Explain how CLT applies to the robot and its sampling of the IR distance sensor.

Q5. Analog Low Pass Filter

The following is 2-pole Butterworth LPF with a cutoff of 32 Hz.



a) What happens if you change both resistors to 32k, without changing the capacitor values?

b) What happens if you change both resistors to 32k, at the same time as changing the 0.22uF to 0.11uF and changing the 0.44uF to 0.22uF?

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Mailing Address: Texas Instruments, Post Office Box 655303, Dallas, Texas 75265