Timers 2

ELE 271: Laboratory 8

Introduction

In this second of two experiments involving timers you will measure the period (and frequency) of a square wave signal. This is known as input capture and you can find some of the details of how this can be accomplished in Section 15.4 of your textbook.

Part 1

In an earlier experiment you estimated the period of an external signal using a software counter. Here the same will be accomplished using a hardware counter, freeing the CPU from keeping a count of the elapsed time.

Review Laboratory 5 for details on how to handle interrupts on the STM32.

Steps

- Select a GPIO pin and connect it to PB505 function generator. Use TTL outputs only! Set the waveform generator output to square wave and 5 KHz. Remember to connect STM32 ground to PB505 ground.
- Select a timer that can be connected to the GPIO pin chosen in (1). Consult AF table.
- Enable Timer X clock (check which bus and register needs to be configured)
- Set the Timer X to input mode (see register TIMX_CCMR1)
- Select appropriate values for the PSC and ARR registers
- Create interrupt handler routine for Timer X
- Enable interrupts on Timer X (TIMX_DIER)
- Enable the output of channel 1, Timer X (see register TIMX_CCER)
- Start the timer (see register TIM2_CR1)

Display and capture the timing waveform using the logic analyzer and the resulting count of the period duration using the STM32CubeProgrammer.

What is the longest interval that you can measure with your PSC and ARR settings and the default MSI clock?

Part 2

Repeat Part 1 for the following frequencies: 5 Hz and 50 KHz. For each frequency provide the timer settings (PSC, ARR, MSI) you selected.

How accurate are your results? If needed, how can they be improved?

If noise becomes an issue, add input filtering and demonstrate its effectiveness.

Part 3 (optional, 5 points)

Set up a measurement in which the timer overflows. Show how to properly handle an overflow condition.