Lab 1
Introduction to Arduino Platform

Q&A

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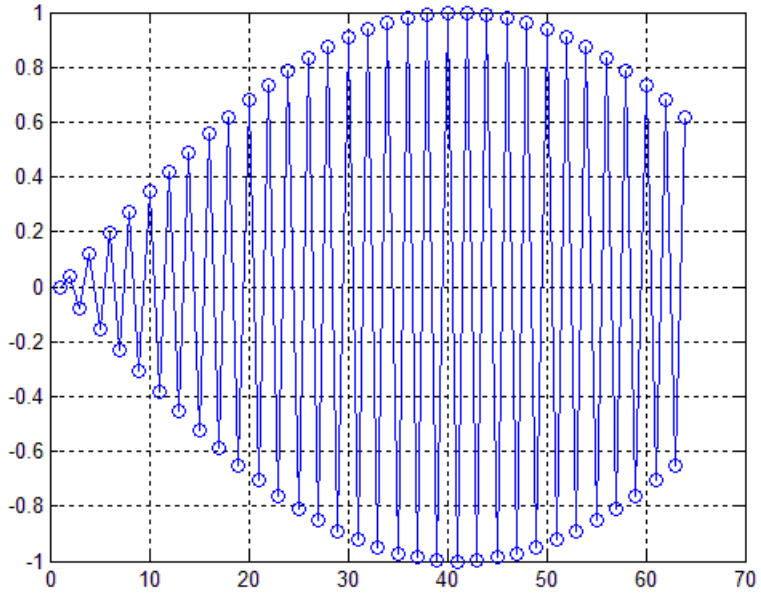
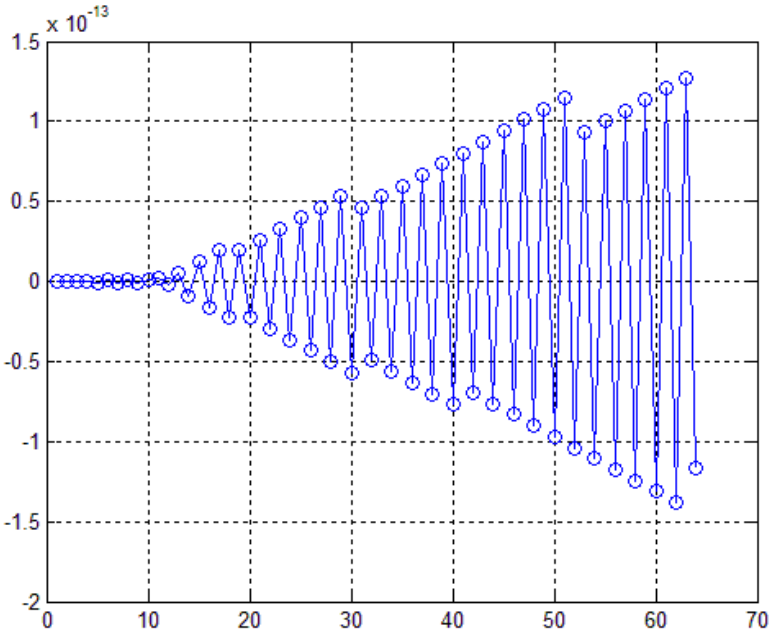
1. 為何取樣後的波形看起來不像你預期的弦波?





http://stackoverflow.com/questions/25658052/why-doesnt-matlab-give-me-an-8khz-sinewave-for-16khz-sampling-frequency

1. 為何取樣後的波形看起來不像你預期的弦波?

- Sampling theorem only guarantees "No aliasing in the FREQUENCY domain", which means the "FREQUECNY" information is preserved after sampling, and does not mean the sampled "WAVEFORM" will be exactly the same as the analog one in the TIME domain.
- See the discussion on STACKOVERFLOW - Why doesn't matlab give me an 8KHz sinewave for 16KHz sampling frequency?
  - http://stackoverflow.com/questions/25658052/why-doesnt-matlab-give-me-an-8khz-sinewave-for-16khz-sampling-frequency

2. 為何fft()畫不出頻譜?

- 請檢查一下儲存信號的MATLAB變數，裡面的值是否有NaN (not a number, you may try isnan() to determine which array elements are NaN)
- 若有的話 (應該是少數幾個值)，請將NaN改為 0即可畫出頻譜

- 至於為何Arduino回傳給PC的值是NaN，可能是Arduino硬體(ADC)在擷取信號時出了問題，也可能是回傳給PC時出了問題

3. 所擷取弦波的Spectrum，畫出來應該是怎麼樣? 為何會有3個impulse? 不是應該正負頻率各一個impulse而已嗎?

NTHU EE LaRC Laboratory for Reliable Computing

The Board We Choose Is Arduino Uno

Name	Processor	Operating Voltage/Input Voltage	CPU Speed	Analog In/Out	Digital IO/PWM	EEPROM [KB]	SRAM [KB]	Flash [KB]	USB	UART
Uno	ATmega328	5 V/7-12 V	16 Mhz	6/0	14/6	1	2	32	Regular	1
Due	AT91SAM3X8E	3.3 V/7-12 V	84 Mhz	12/2	54/12	-	96	512	2 Micro	4
Leonardo	ATmega32u4	5 V/7-12 V	16 Mhz	12/0	20/7	1	2.5	32	Micro	1
Mega 2560	ATmega2560	5 V/7-12 V	16 Mhz	16/0	54/15	4	8	256	Regular	4
Mega ADK	ATmega2560	5 V/7-12 V	16 Mhz	16/0	54/15	4	8	256	Regular	4
Micro	ATmega32u4	5 V/7-12 V	16	12/0	20/7	1	2.5	32	Micro	1

- DC current per I/O pin: 40 mA
-0.5 KB Flash memory used by bootloader
-6 analog inputs (A0 to A5), each of which provide 10 bits of resolution (i.e. 1024 different values) from ground to 5 volts by default (http://arduino.cc/en/Reference/AnalogRead)
-It is possible t change the upper end of their range using the AREF pin and the analogReference() function

ADC (input range and number of bits)

DC component

4. What Would Happen If You Set a Smaller Baud Rate, i.e., < 115200 bps?

- 如果data acquisition rate 大於data transfer rate，會發生什麼事?

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- 還有件事要注意

```
void loop() {
  // put your main code here, to run repeatedly:

  start_time = micros();

  val = analogRead(pot);    //read analog input <==== DATA ACQUISTION at sampling rate, e.g., M Hz

  val = map(/***************/);    //mapping

  Serial.println(val,DEC);     //print on Matlab   <===== DATA TRANSFER TO PC via serial communication at Baud rate, e.g., N bps

  now_time = micros();

  while(now_time-start_time<5000){    //sample rate
    now_time = micros();
  }
```

5. Arduino 無法寫入，可能出了什麼問題?

- 檢查Arduino IDE上Board及Port的設定是否正確
- 確定MATLAB端的程式碼有執行到fclose()，有將對應的serial port關閉並將使用權還給作業系統。若沒有fclose()，MATLAB會佔住該serial port，不讓Arduino IDE使用，而無法upload compile後的程式碼。

6. MATLAB無法使用Arduino對應的serial port?

- 請記得關掉Arduino IDE的Serial monitor，serial monitor會把該serial port佔住不讓其他程式使用

7. Arduino 與 PC 連接的USB Cable該怎麼接?

- 如果Arduino常無法寫入或工作不正常，在問題5的解決方案不管用時，建議從Arduino接到PC端的USB cable最好能直接接到主機板上的USB port，然後再測試看看。