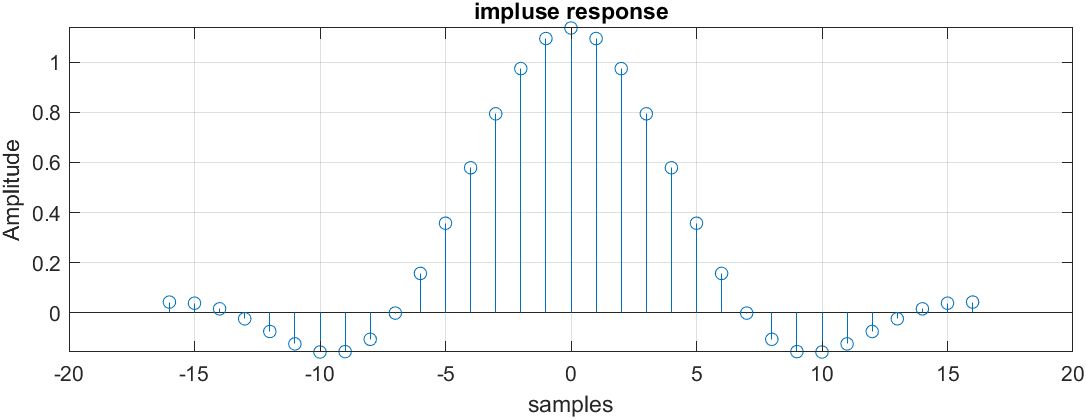
**DCCDL LAB3**

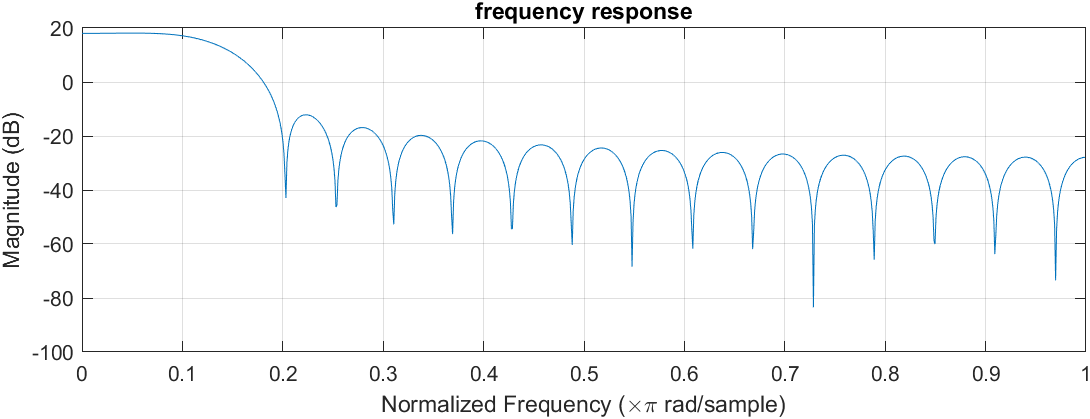
**matlab**

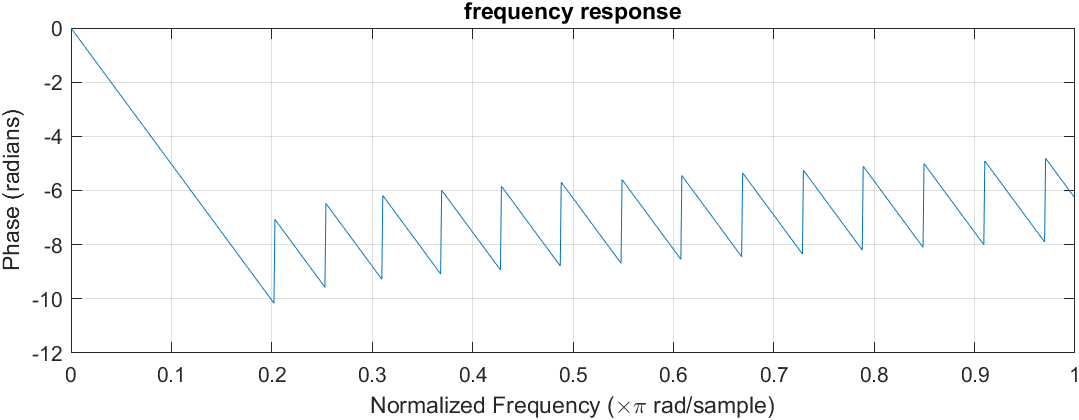
電機碩一 111521035 林豪澤

1. Please use Matlab to draw the impulse response and frequency response of the 33-tap square-root raised-cosine FIR filter. Note that you need to use scale in dB for the magnitude of the frequency response and use radian for the phase of frequency response versus normalized frequency. The x-axis must be marked with correct the label. Please explain whether the filter is high-pass, band-pass or low-pass and why.

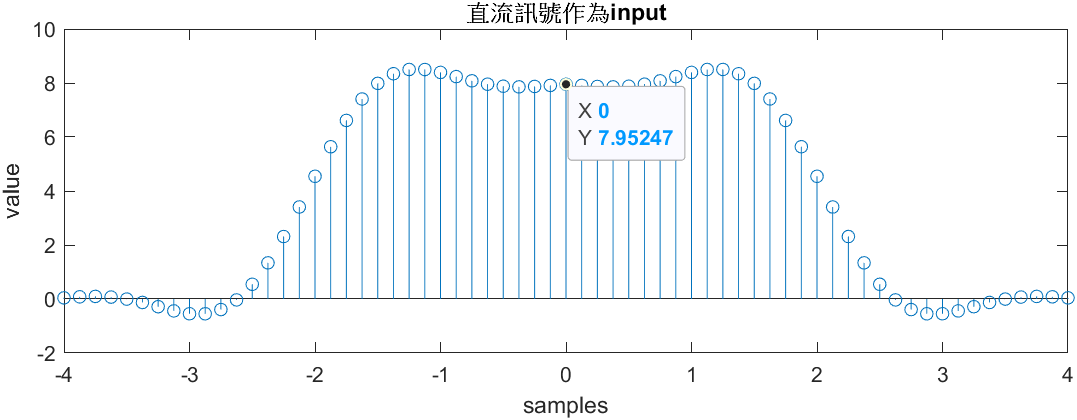
impluse response: 

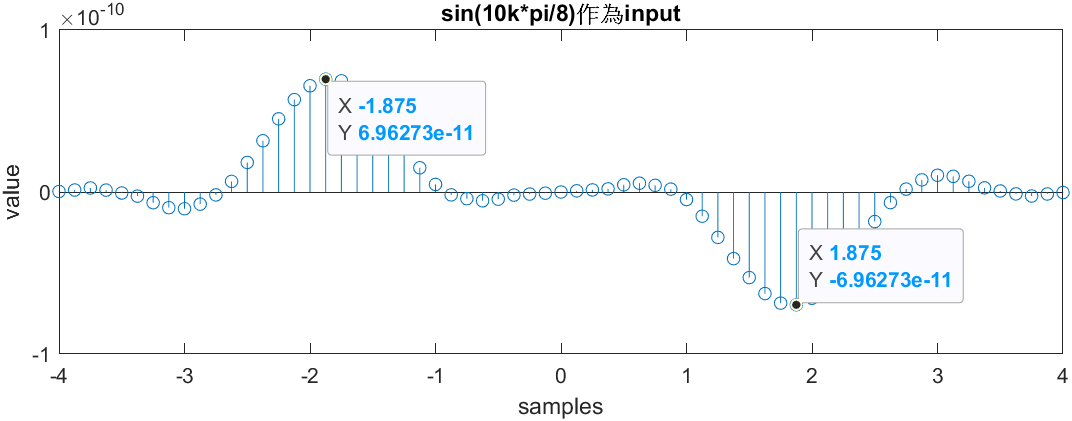
frequency response:



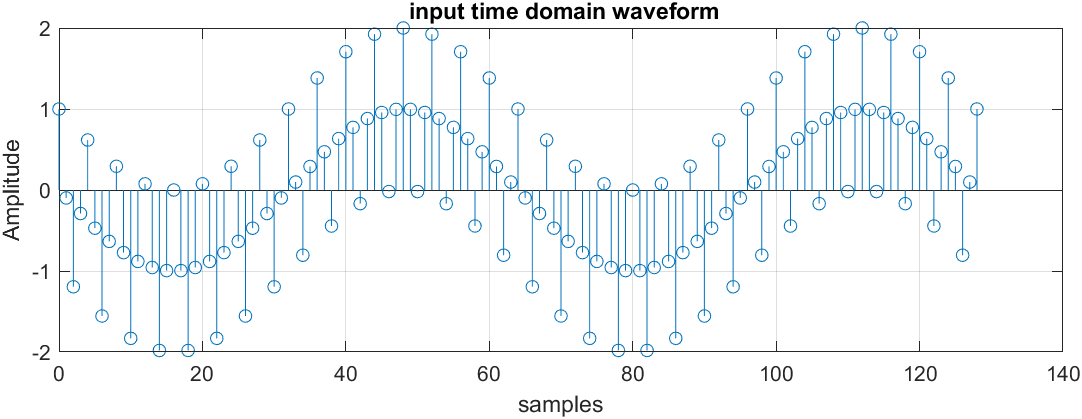


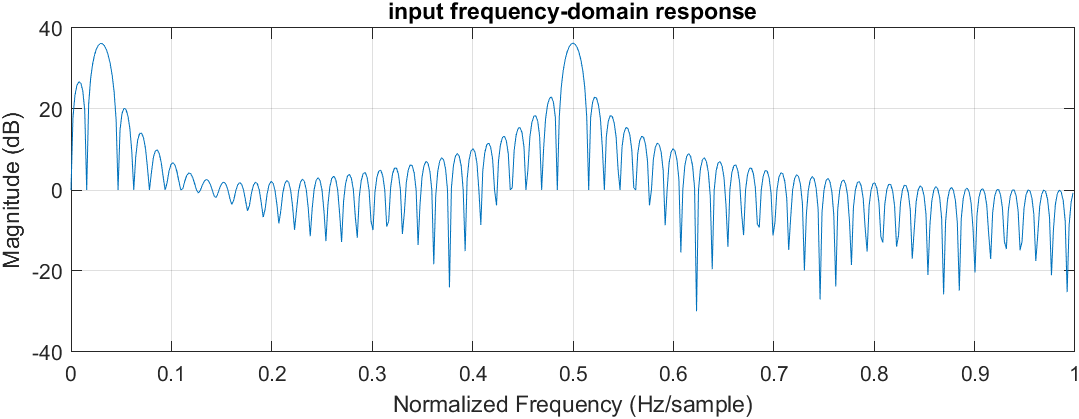
此filter是一個low-pass之濾波器，使用直流訊號與高頻訊號與之convolution後的結果，高頻訊號幾乎消失，而直流訊號還存在。故為低通濾波器。

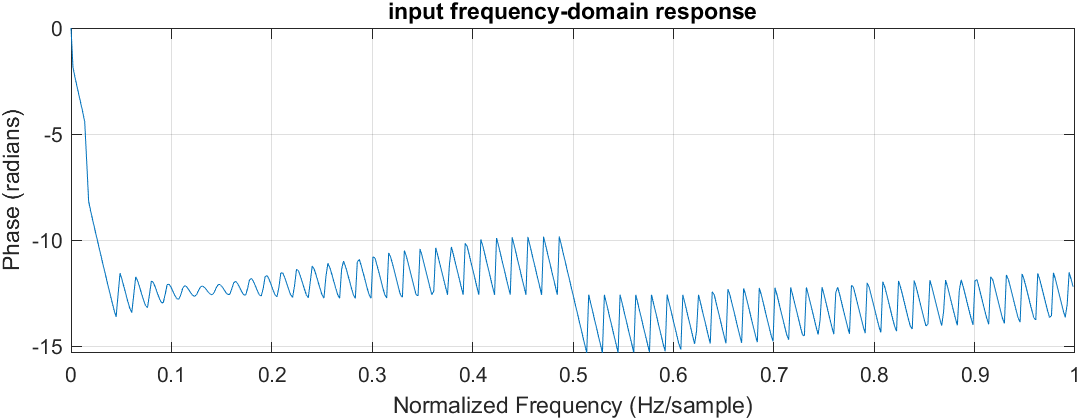


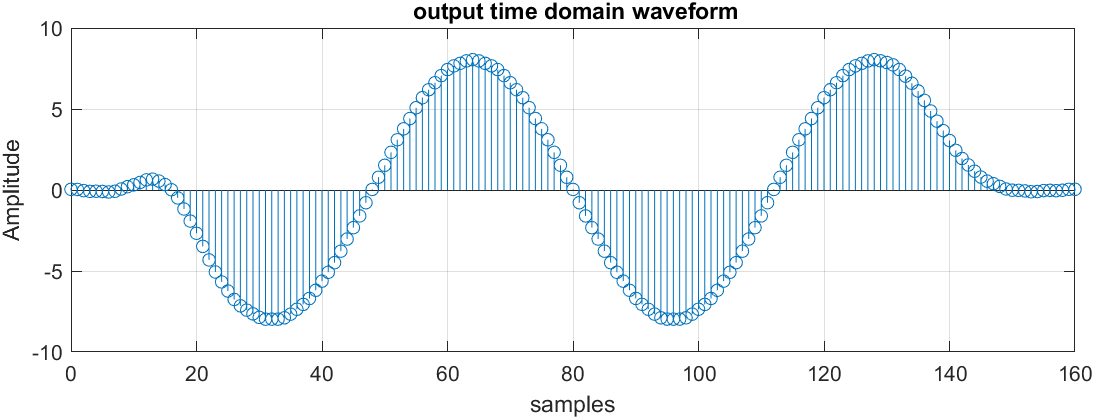


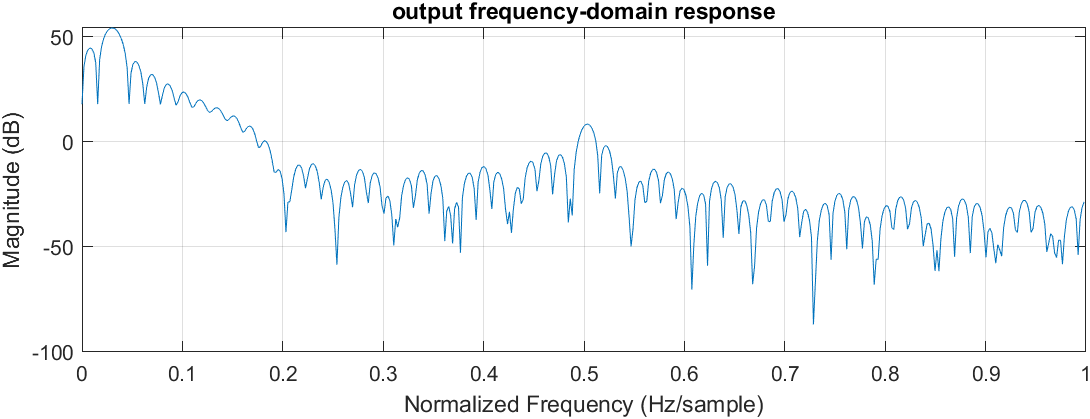
1. Draw the time-domain waveform and frequency-domain response of the input and output in procedure 2.

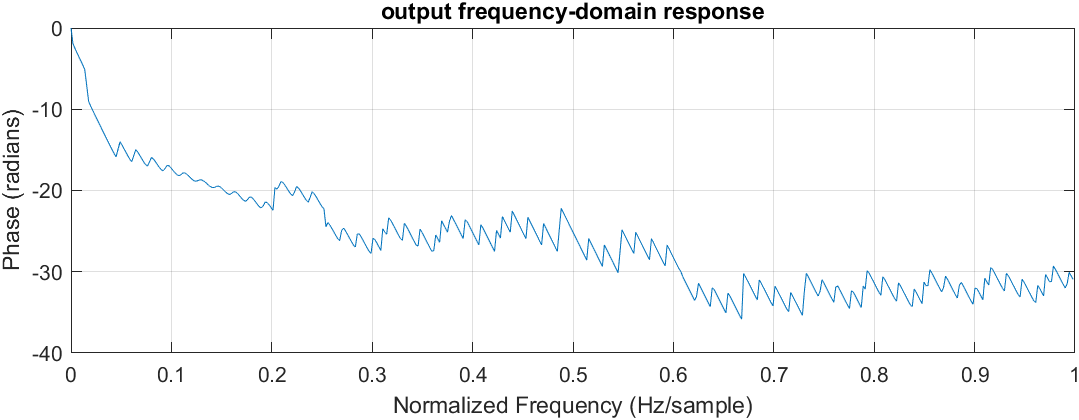




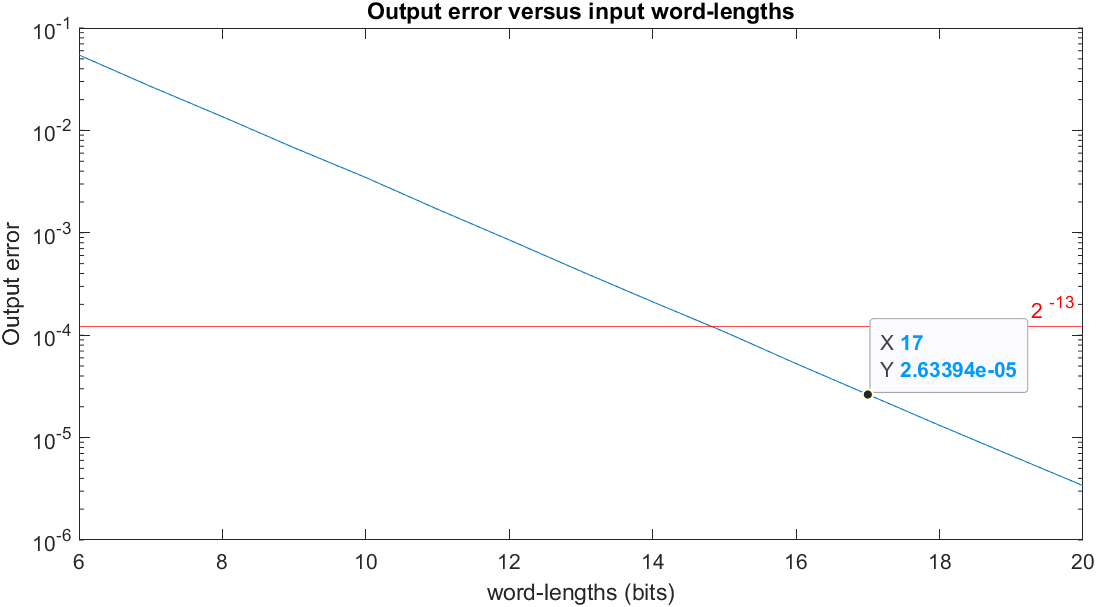




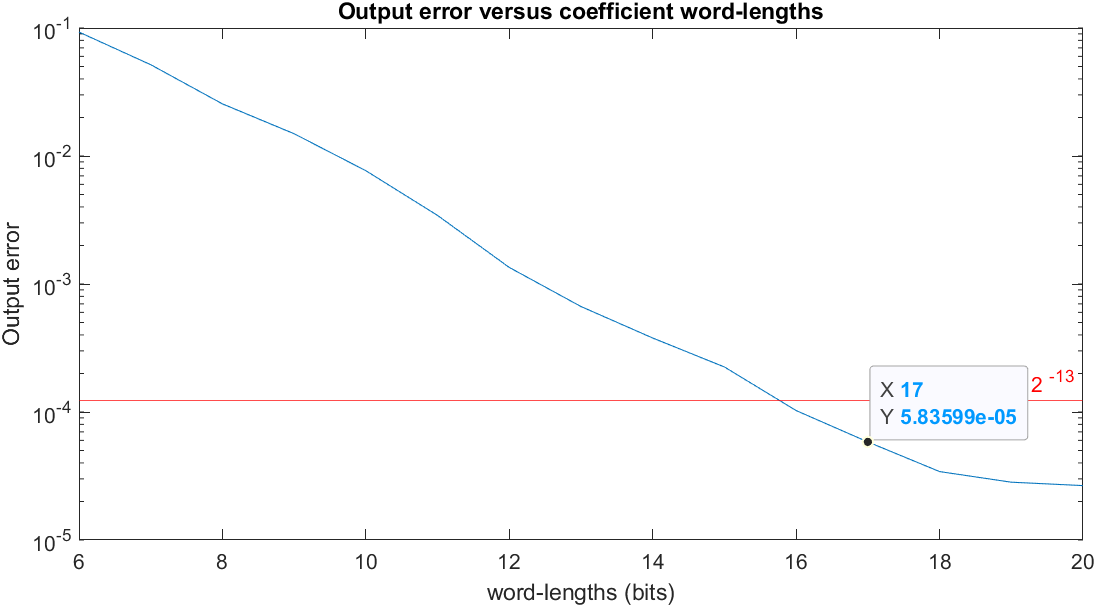




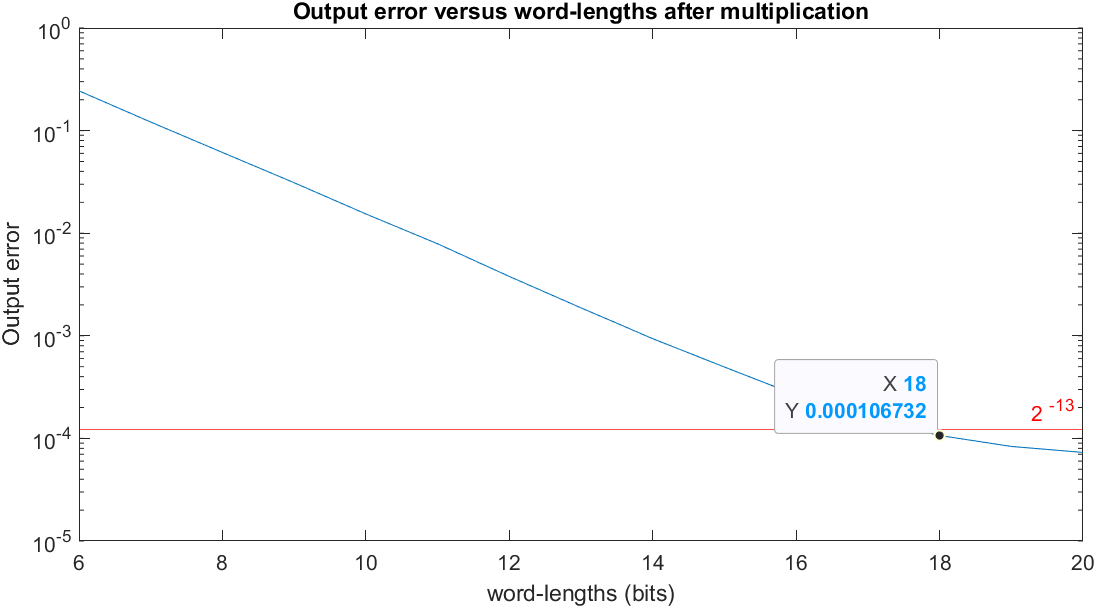
1. To show how you determine the word-length, please use the word-length of data paths as the X-axis and error as the Y-axis. Scan the quantization error versus the word-length. Mark the word-length settings in the block diagram of the direct form FIR filter.
2. Output error versus input word-lengths



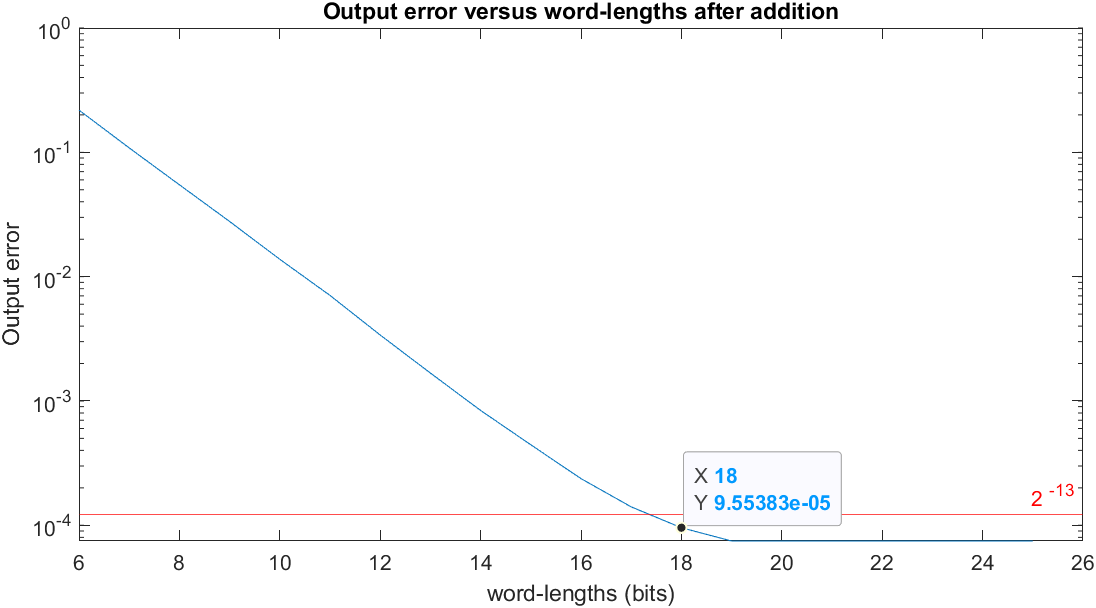
1. Output error versus coefficient word-lengths

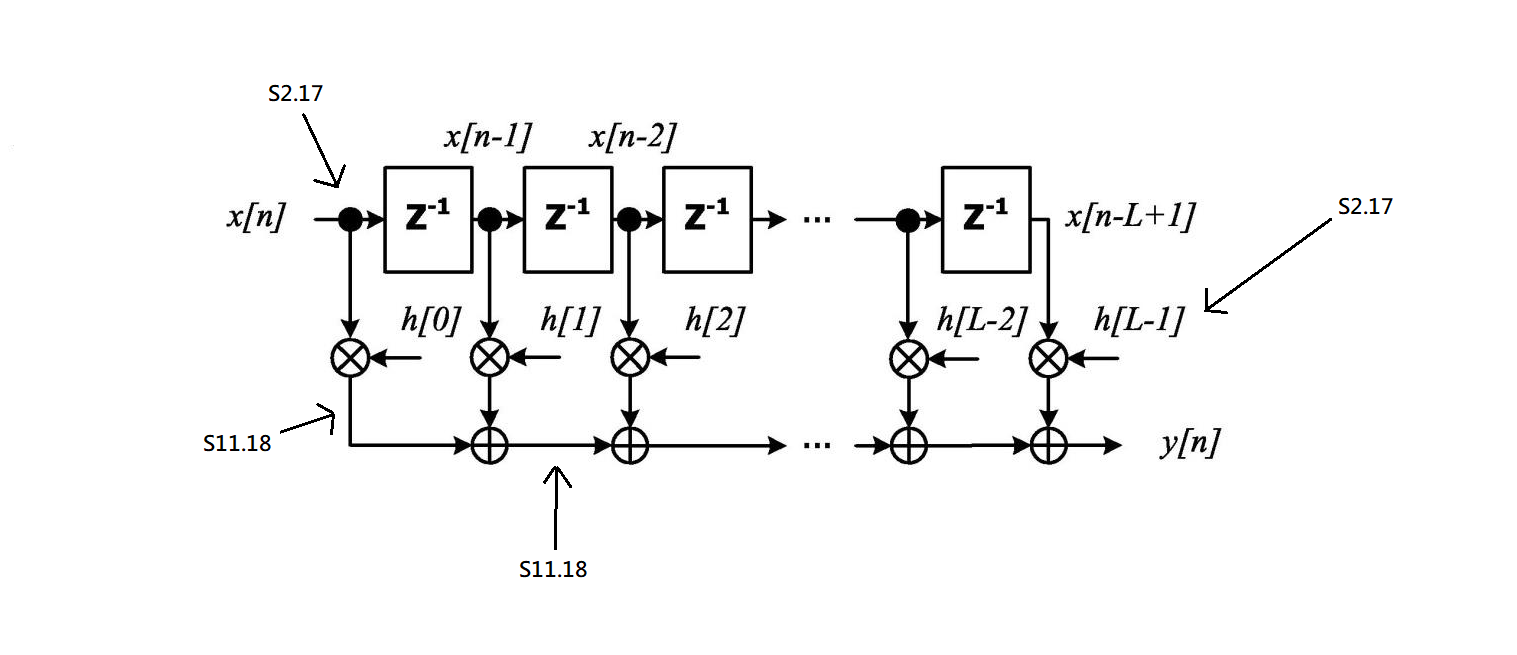


1. Output error versus word-lengths after multiplication



1. Output error versus word-lengths after addition





Inputs 之最大值不大於2、最小值不小於-2，因此只需要考慮小數部位的經度有沒有符合條件，sign bit + 2bits 的整數部分用來存放小數點左邊的數值，而經過運算後小數部分給定17個bits。因此input之word length 可表示成S2.17

coefficient 之最大值不大於2、最小值不小於-2，因此只需要考慮小數部位的經度有沒有符合條件，sign bit + 2bits 的整數部分用來存放小數點左邊的數值，而經過運算後小數部分給定17個bits。因此coefficient之word length 可表示成S2.17

word-lengths after multiplication之決定則是由於乘法的性質，原本要將inputs 與 coefficient相乘後的結果訂為 S5.34，但是經過量化之後小數部分只剩18個bits。

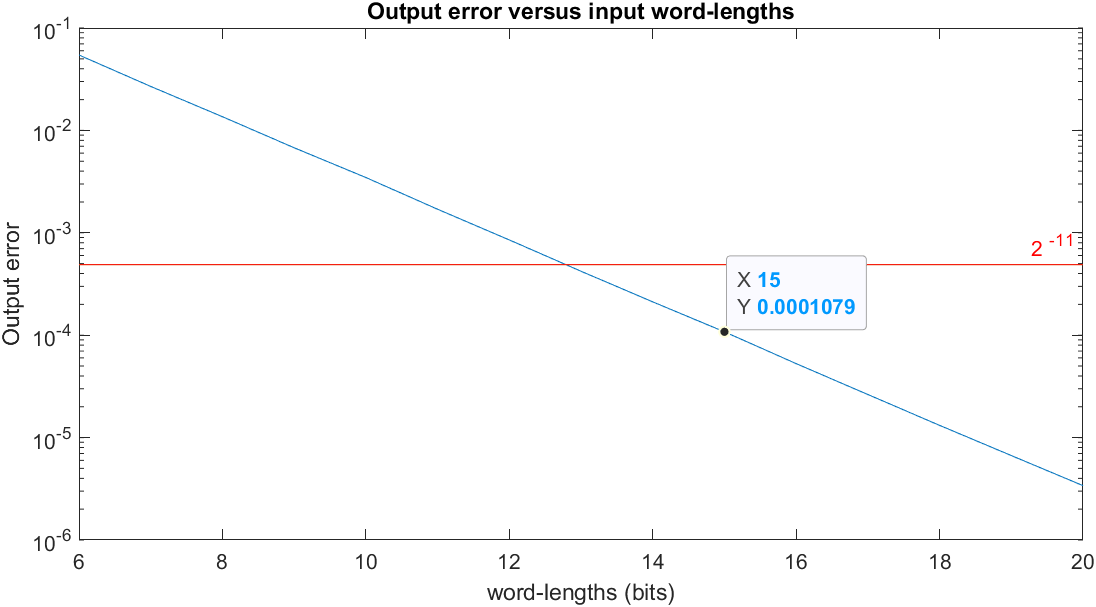
而小數點左方則是配合加法需要擴展6個bits，word-lengths為S11.18。

Word-length after addition 之決定則是由於乘法過後的小數位精度已經確定，加法則需要考慮溢位之部分。我們可以知道兩個word-lengths 相當的數需要留 1 bit 來防止溢位，四個word-lengths相當的數則需要 2bits，以此類推33個word-lengths相當的數相加需要加上6個bits。原本相乘完的word-length為S5.18，由於加法需要則擴展為S11.18

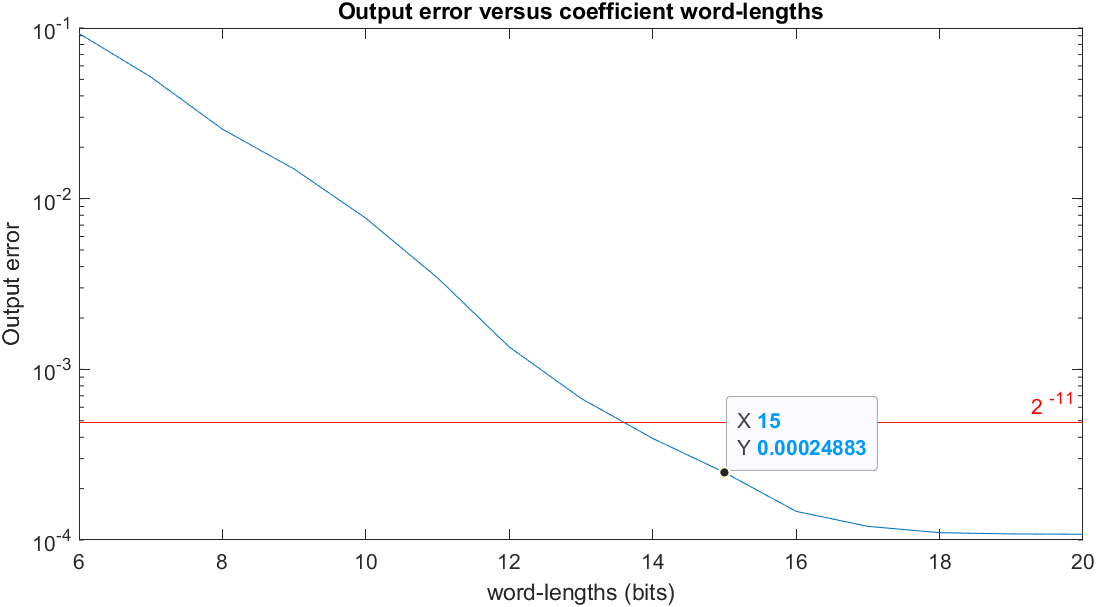
1. To show how you determine the word-length, please use the word-length of coefficients as the X-axis and error as the Y-axis. Scan the quantization error versus the word-length. Mark the word-length settings in the block diagram of the transposed form FIR

filter.

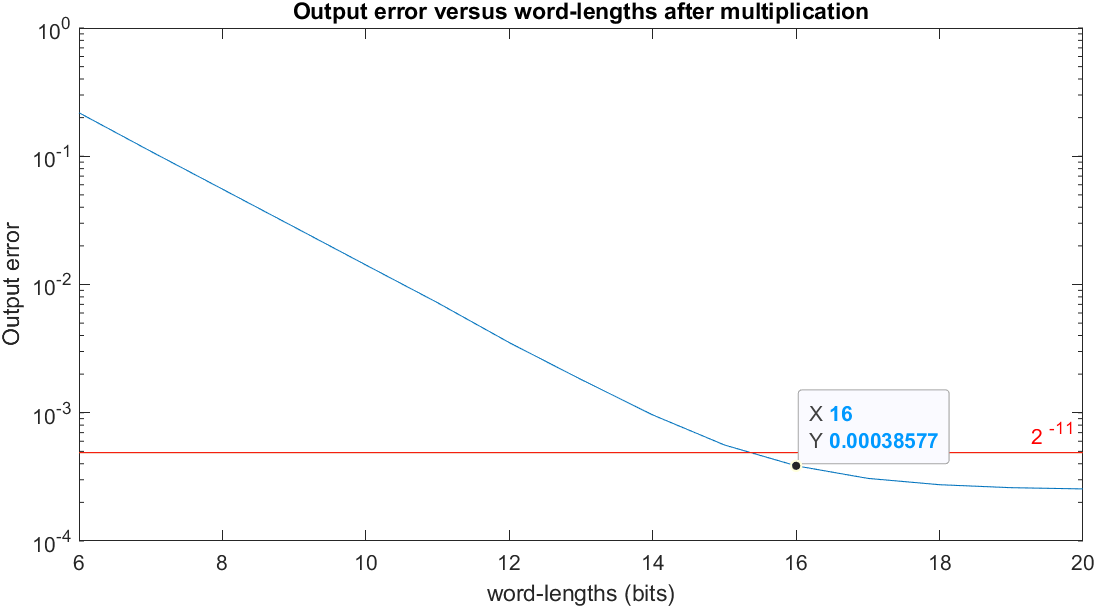
1. Output error versus input word-lengths



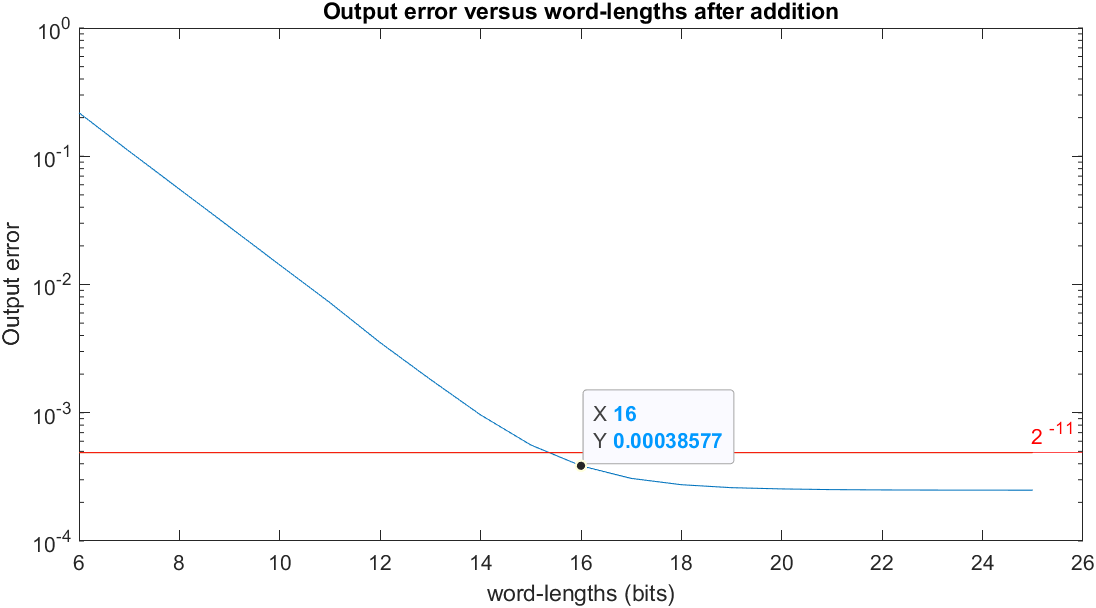
1. Output error versus coefficient word-lengths

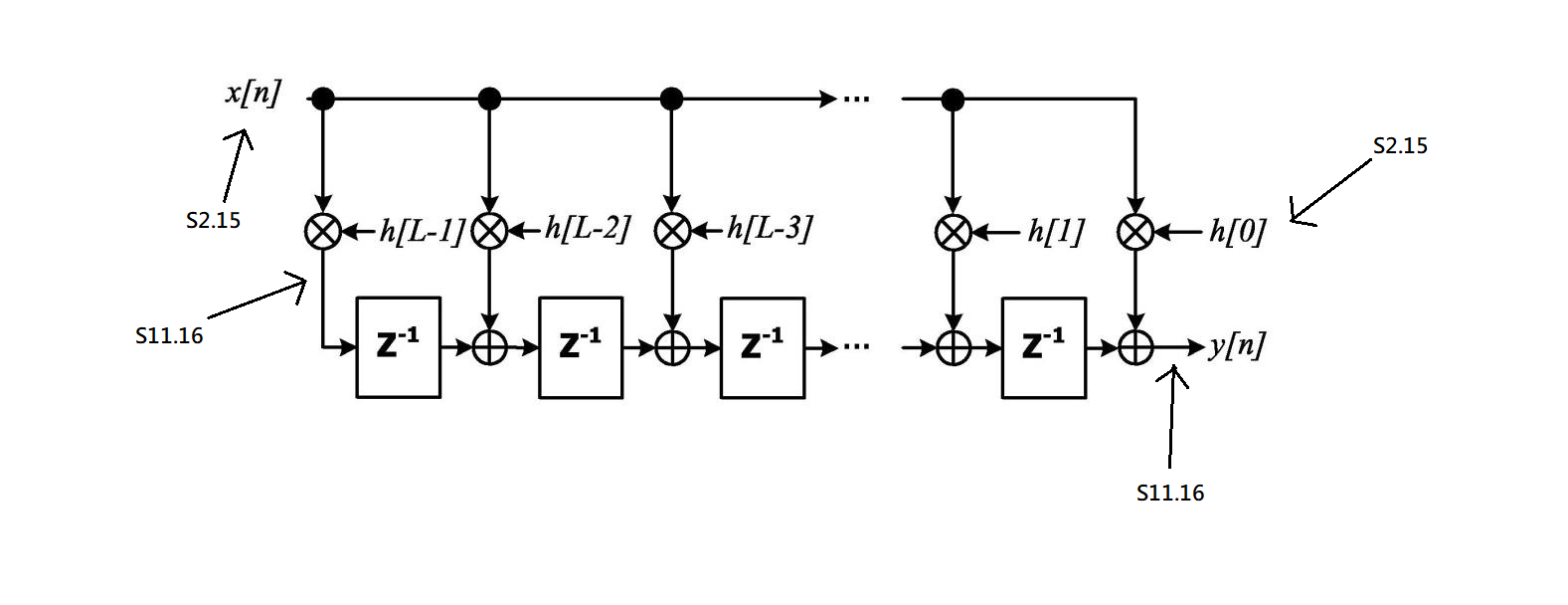


1. Output error versus word-lengths after multiplication



d. Output error versus word-lengths after addition





Inputs 之最大值不大於2、最小值不小於-2，因此只需要考慮小數部位的經度有沒有符合條件，sign bit + 2bits 的整數部分用來存放小數點左邊的數值，而經過運算後小數部分給定15個bits。因此input之word length 可表示成S2.15

coefficient 之最大值不大於2、最小值不小於-2，因此只需要考慮小數部位的經度有沒有符合條件，sign bit + 2bits 的整數部分用來存放小數點左邊的數值，而經過運算後小數部分給定15個bits。因此coefficient之word length 可表示成S2.15

word-lengths after multiplication之決定則是由於乘法的性質，原本要將inputs 與 coefficient相乘後的結果訂為 S5.30，但是經過量化之後小數部分只剩16個bits。

而小數點左方則是配合加法需要擴展6個bits，word-lengths為S11.16。

Word-length after addition 之決定則是由於乘法過後的小數位精度已經確定，加法則需要考慮溢位之部分。我們可以知道兩個word-lengths 相當的數需要留 1 bit 來防止溢位，四個word-lengths相當的數則需要 2bits，以此類推33個word-lengths相當的數相加需要加上6個bits。原本相乘完的word-length為S5.16，由於加法需要則擴展為S11.16