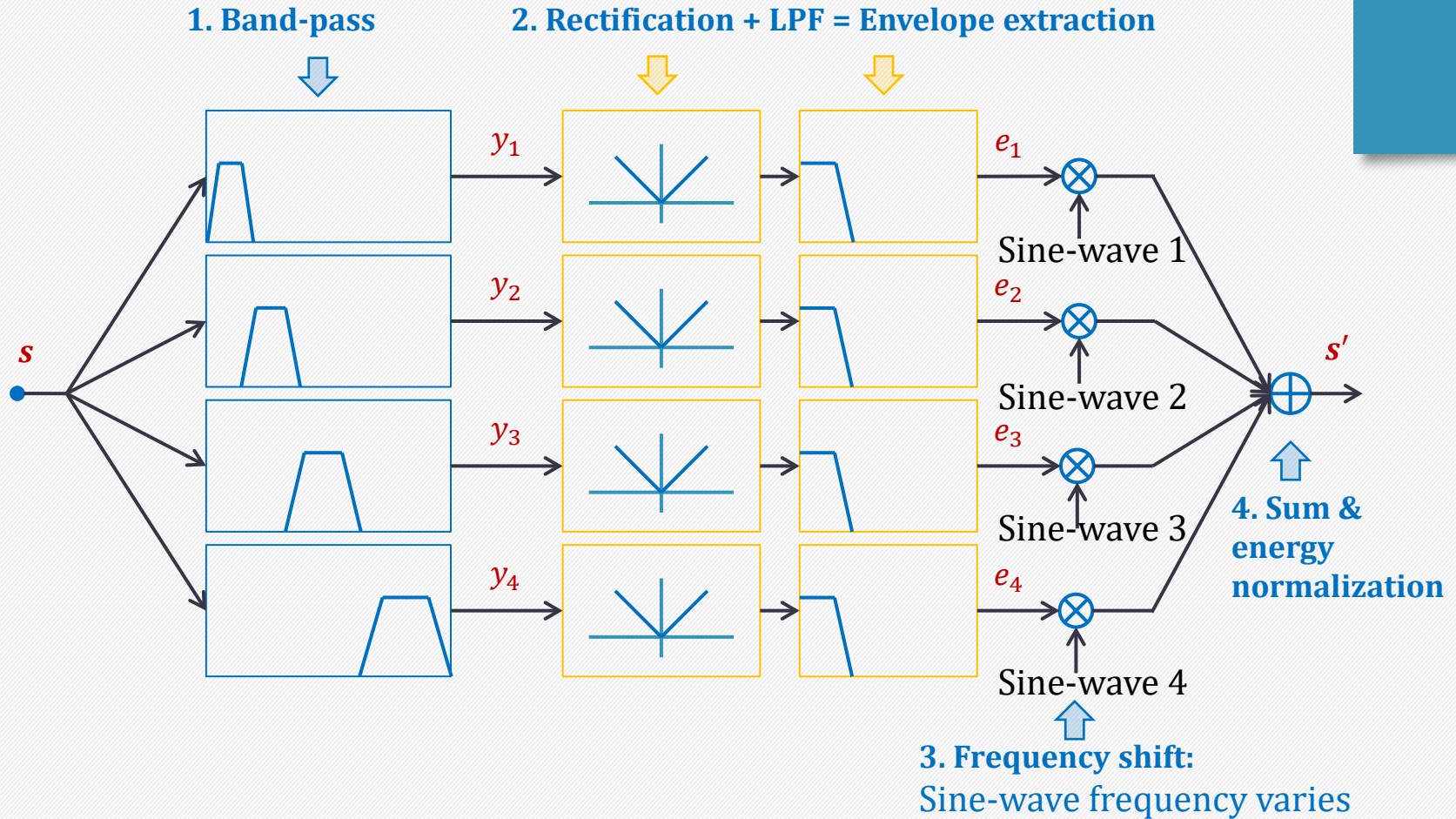


# Common problems in Project 1

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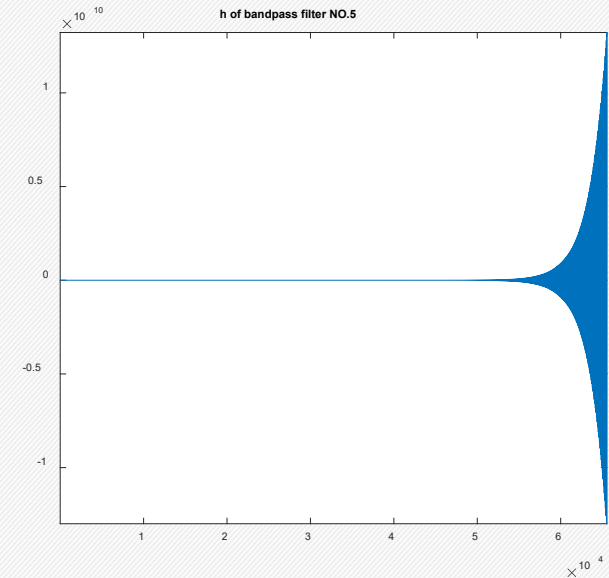
Dec. 2021 updated



# 1. Unstable filter

- The bandwidths of the filters decrease with the increasing of  $N$ .
- A filter will be unstable when the band is too narrow.

The impulse response of the 5<sup>th</sup> pass band filter when  $N = 200$ , and the filter order of is 4

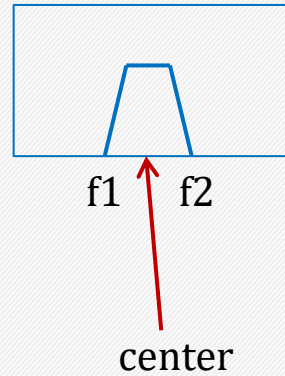


## 2. Sinusoidal signal generation

- $\text{Sinsig} = \sin(2\pi f t) \rightarrow$  CT signal, ( $f$  – frequency in Hz)
- In Matlab, the Sinsig should be represented as a DT signal with the same sampling frequency as the original voice signal
- $\text{Sinsigdt} = \sin(2\pi f n dT)$ ,  $dT$  is the sampling interval
  - $dT = 1/f_s$
  - $n = 1:N$

### 3. Center frequency of $[f_1, f_2]$

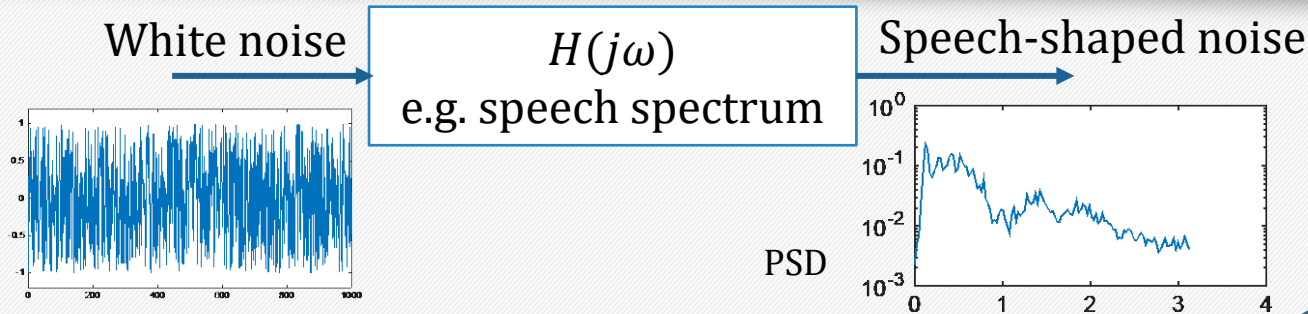
- $(f_2 - f_1)/2$  ?
- $(f_2 + f_1)/2$  ?



## 4. SSN, remember?

- Speech Shaped Noise, SSN
- As required in Project 1, the noise added to the original speech signal should be a SSN
  - **White noise**, the code '`noise = 1-2*rand(1,N)`' generates
  - Feed this white noise into a specifically designed filter to generate SSN, as what we've done in Lab 5

## 5. SNR = -5dB



1. Do you know the energy (or 2-norm) of the SSN obtained by filtering the white noise?
2. How do you know?
3. How much energy (or 2-norm) should the SSN has so that the SNR relative to the voice signal is -5dB?

## 5. SNR = -5dB (cont.)

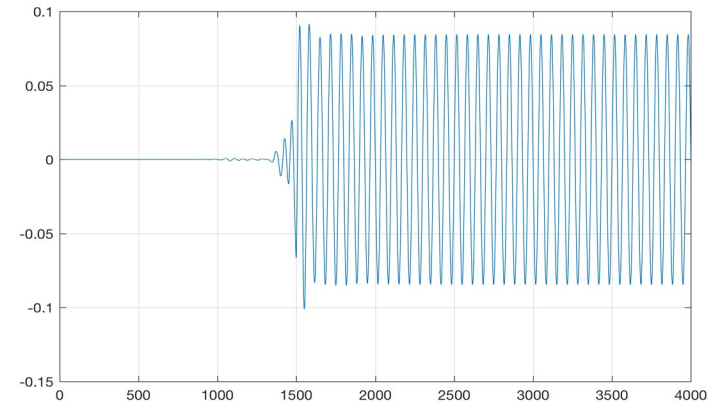
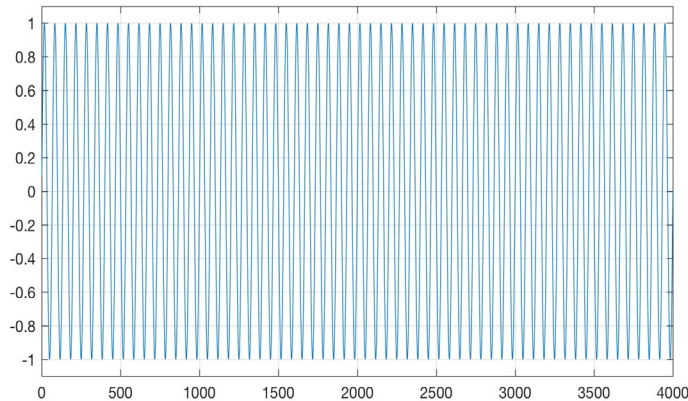
- `normratio = 10^(-5/20); % 0.5623`
- `SSN = SSN*/norm(SSN)*norm(s) /normratio;`
- `SNR = 20*log10(norm(s)/norm(SSN))`

```
>> SNR = 20*log10(norm(s)/norm(SSN))  
  
SNR =  
  
-5.0000
```



## 6. Effect of filter length on filtered signal

- The length of the FIR filter used to generate SSN is 3001, that'll cause non-negligible delay of the filtered signal from the original signal.
  - `sig1 = sin(2*pi*0.015*(1:4000));`
  - `sig2 = filter(b,1,sig1);`

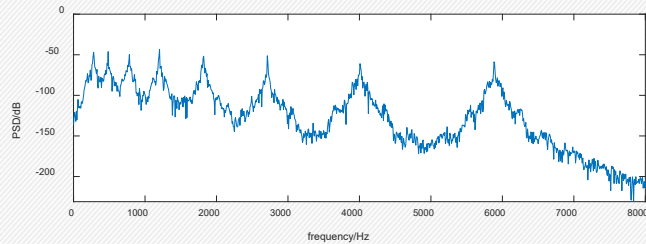
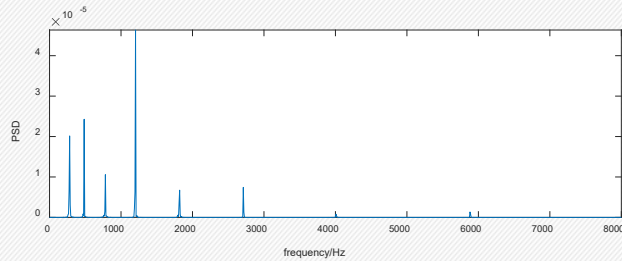
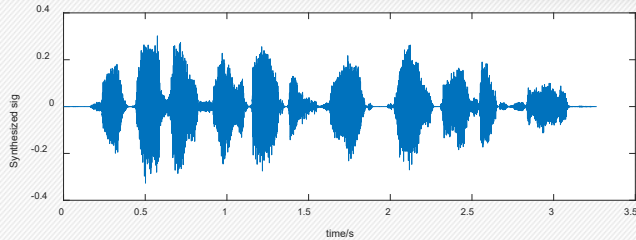


## 6. Effect of filter length on filtered signal (cont.)

- Solution: Generate overlength SSN and Discard the beginning 1500 or more points

```
N = length(s);  
noise=1-2*rand(1,length(b)+N);  
SSN = filter(b,1,noise);  
SSN = SSN((length(b)+1):end);
```

## 7. Spectrum display



`plot(w, 10*log10(Pxx))`

Or

`semilogy(w, Pxx)`

