PFB

January 20, 2021

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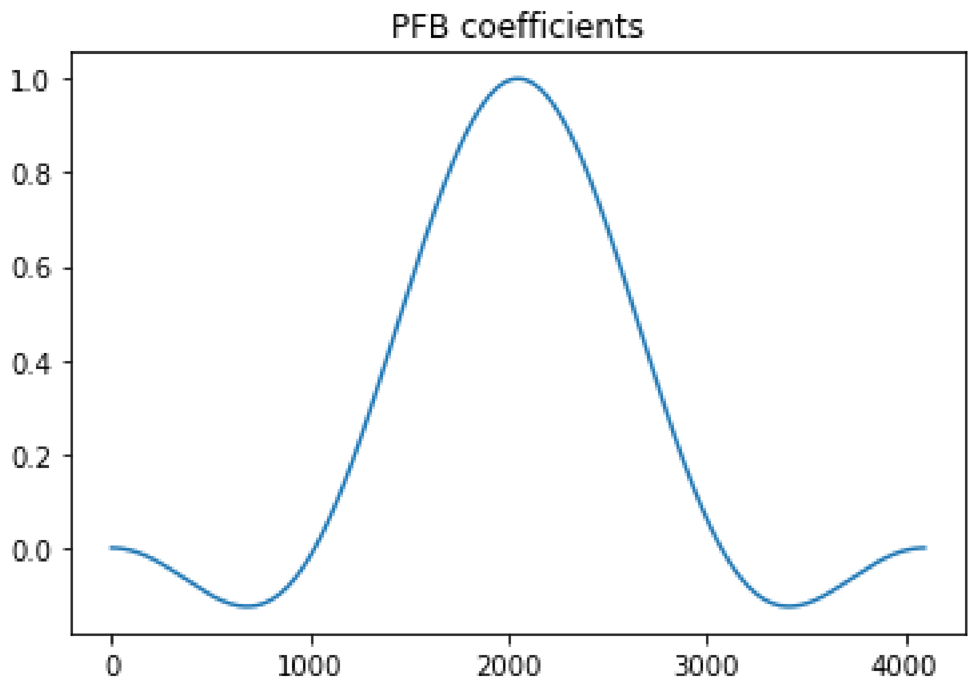
In [1]: import numpy as np
        import matplotlib.pyplot as plt

In [8]: #Calculate the weight of the filter bank
        def GetW(Nfft,P=4):
            M=Nfft*P
            W=np.arange(0,M,1)
            flt=np.zeros([M])
            #P=P-1
            flt[0:P-2]=1;
            flt[P-2]=0.5;
            flt[-P+3:]=1;
            flt[-P+2]=0.5;
            W=np.fft.ifft(flt).real #Imag part should be zero
            W=np.roll(W,M//2)
            return W*Nfft

        #Apply the PFB to data
        def fftw(A,W,P=4):
          Nfft=A.shape[-1]
          Dx=A[:,:-P,:]*W[:Nfft]
          for i in range(P-1):
            S=(i+1)*Nfft
            Dx+=A[:,i+1:-P+i+1,:]*W[S:S+Nfft]
          return (np.fft.fft(Dx,axis=2))

In [11]: P=4
         Nfft=1024; #FFT length
         W=GetW(Nfft,P=P)
         plt.plot(W);
         plt.title("PFB coefficients");
```



```
In [22]: #Load Data
         Nc=3; #Number of channels

         A=np.array(np.load("../LabTest8/D6b.npy")) #Raw ADC data
         A-=65536*(A>65536//2)
         print(A.shape)
         [n1,n2,n3]=A.shape

         A=A.reshape([n1,n3//Nfft,Nfft])
         print(A.shape) #Channels*seconds, blocks, fft length
```

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(192, 1, 131072)
(192, 128, 1024)
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In [ ]:
```

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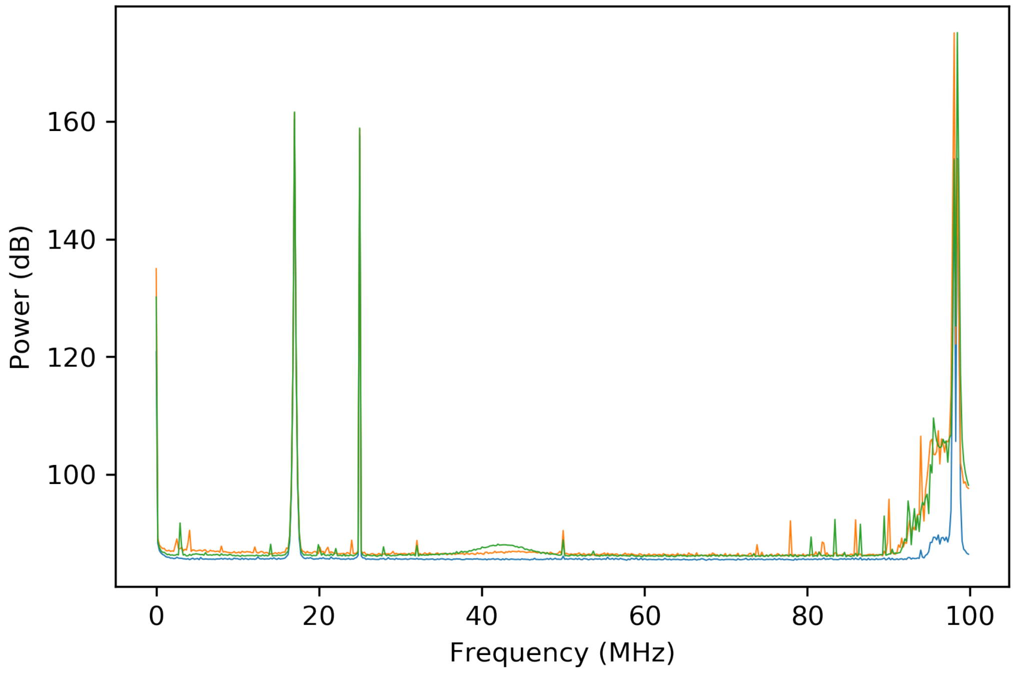
In [23]: #Do FFT
         F=fftw(A,W,P=P)
         [n1,n2,n3]=F.shape
         F=F.reshape([n1//Nc,Nc,n2,n3])
         F=F.swapaxes(0,1)
         F=F.reshape([Nc,n1//Nc*n2,n3])
         print(F.shape) #channels, blocks, ffts
```

```
(3, 7936, 1024)
```

```
In [26]: #plot power
         FP=np.sum((F*F.conj()).real,axis=1)[:,:Nfft//2]
         FP=10*np.log10(FP)
         freq=np.arange(0,Nfft//2,1)/(Nfft//2)*100
         plt.figure(dpi=300)
         plt.plot(freq,FP.T,linewidth=0.5);
         plt.xlabel("Frequency (MHz)")
         plt.ylabel("Power (dB)")

Out[26]: <matplotlib.text.Text at 0x7fb3fbe9f748>
```



```
In [ ]:
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