

```
# -*- coding: utf-8 -*-
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"""
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Created on Sun Mar 27 09:25:26 2016
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@author: Dom
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"""
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```
import numpy
import math
from matplotlib.pyplot import *
import scipy.signal
```

```
P=150
```

```
h = numpy.zeros(2*P+1)
```

```
def sinc(u):
```

```
    if u==0:
```

```
        return 1.0
```

```
    else:
```

```
        return math.sin(math.pi*u)/(math.pi*u)
```

```
a=1.0/20
```

```
for k in range(2*P+1):
```

```
    h[k] = 2*a*sinc(2*(k-P)*a)
```

```
indices = numpy.arange(2*P+1)
```

```
figure(figsize=(8,4))
```

```
vlines(indices,[0],h)
```

```
grid()
```

```
def reponseFreq(h):
```

```
    N = h.size
```

```

def Hf(f):
    s = 0.0
    for k in range(N):
        s += h[k]*numpy.exp(-1j*2*math.p:
    return s
f = numpy.arange(start=0.0, stop=0.5, step:
hf = Hf(f)
g = numpy.absolute(hf)
phi = numpy.unwrap(numpy.angle(hf))
return [f,g,phi]

```

```

(f,g,phi)=reponseFreq(h)
fe = 20000
figure(figsize=(6,4))
plot(f*fe,g)
xlabel('f (Hz)')
ylabel('|H|')
axis([0,2000,0,2])
grid()

```

```

h = h*scipy.signal.get_window("hamming",2*P+:
(f,g,phi)=reponseFreq(h)
figure(figsize=(6,4))
plot(f*fe,g)
xlabel('f (Hz)')
ylabel('|H|')
axis([0,2000,0,2])
grid()

```

