Reconstrução da STFT

In [133]:
```
using Pkg
Pkg.activate("/Users/vitor/arquivos/docs/cursos/Julia")
using PyPlot, SampledSignals, DSP, FFTW
include("/Users/vitor/arquivos/julia/pfft.jl")
include("/Users/vitor/arquivos/docs/cursos/Julia/kaiser.jl")
include("/Users/vitor/arquivos/docs/cursos/Julia/istft.jl")
include("/Users/vitor/arquivos/docs/cursos/Julia/plota_stft.jl")
```

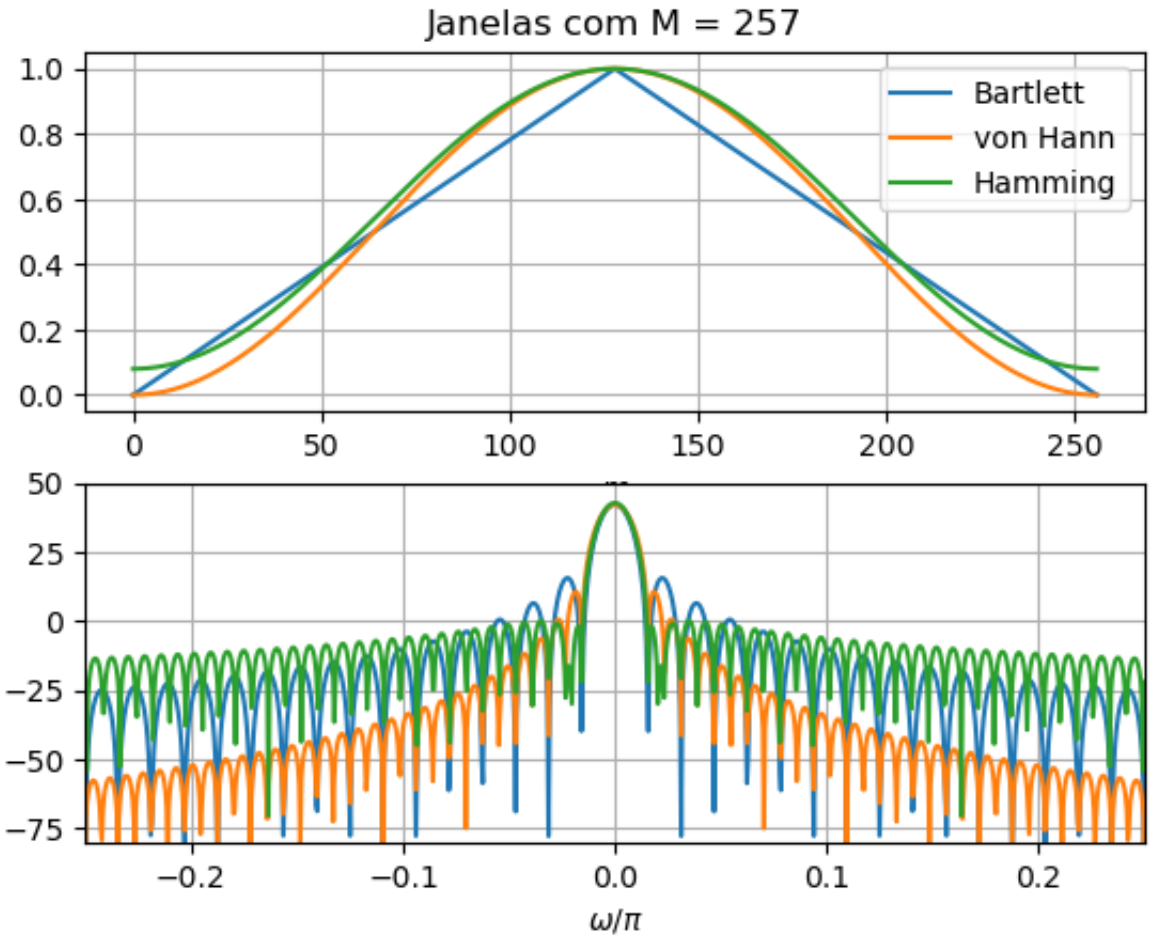
```
 Activating environment at `~/arquivos/docs/cursos/Julia/Project.t
oml`
```

Out[133]:
```
plota_stft
```

Parâmetros para a reconstrução

In [2]:
```
M = 257 # Comprimento das janelas
Q = 8 #
R = (M-1)÷Q # Deslocamento no tempo
m = 0:M-1
L = (M-1)/2
N = 1024 # Número de pontos para as FFTs
wB = bartlett(M)
wHn = hanning(M)
wH = hamming(M);
```

In [3]:
```
subplot(211)
plot(m, wB, label = "Bartlett")
plot(m, wHn, label = "von Hann")
plot(m, wH, label = "Hamming")
title("Janelas com M = $M")
grid()
legend()
xlabel(L"m")
subplot(212)
ω = range(-π, π, length = 1000)/4
WB = freqz(PolynomialRatio(wB, [1]), ω)
WHn = freqz(PolynomialRatio(wHn, [1]), ω)
WH = freqz(PolynomialRatio(wH, [1]), ω)
plot(ω/π, amp2db.(abs.(WB)), label = "Bartlett")
plot(ω/π, amp2db.(abs.(WHn)), label = "von Hann")
plot(ω/π, amp2db.(abs.(WH)), label = "Hamming")
grid();
xlabel(L"\omega/\pi");
axis([-0.25, 0.25, -80, 50])
```



Out[3]: (-0.25, 0.25, -80.0, 50.0)

Sinal de teste

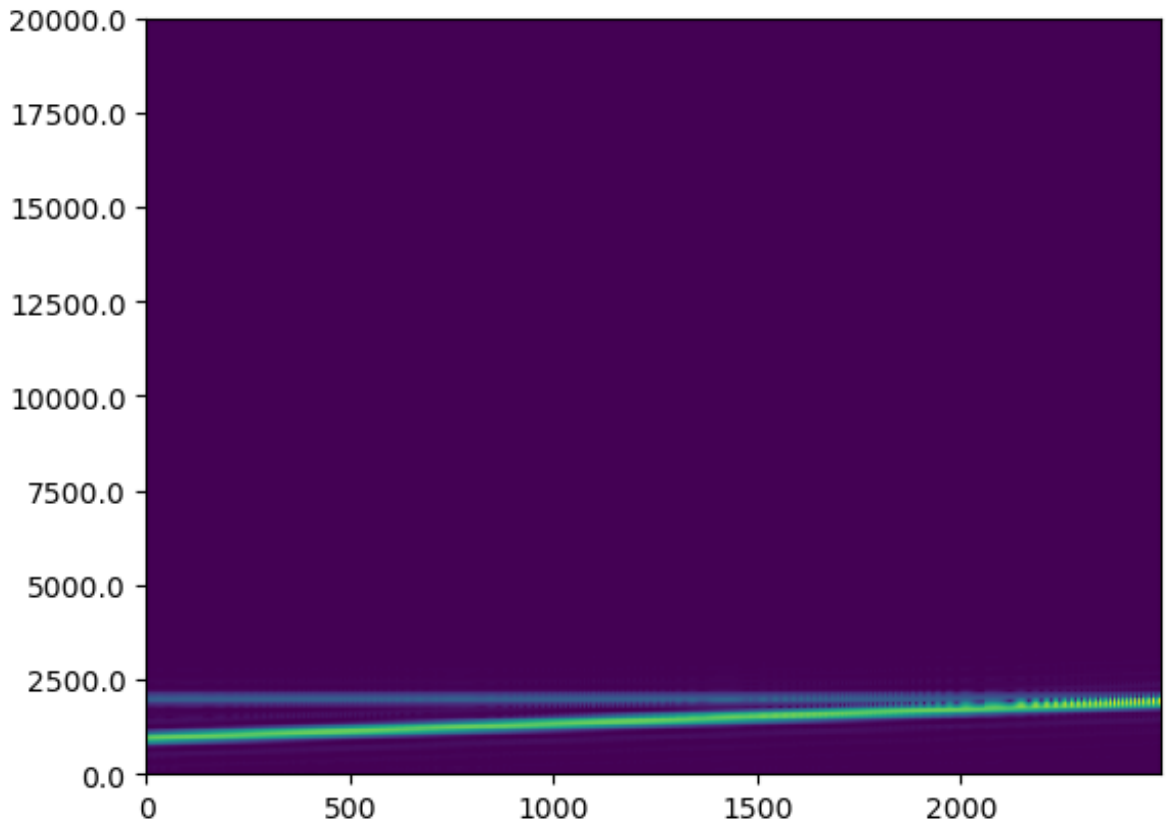
In [4]:
```
fa = 40_000
Ta = 1/fa
t = 0:Ta:2;
Ω0 = 6*1000
ΔΩ = 6*1000 / t[end]
x = 0.65sin.((Ω0 .+ 0.5*ΔΩ * t) .* t)+0.25cos.(2π*2000t);
xb = SampleBuf(x, fa)
```

Out[4]:

-0:02

Janela de Bartlett

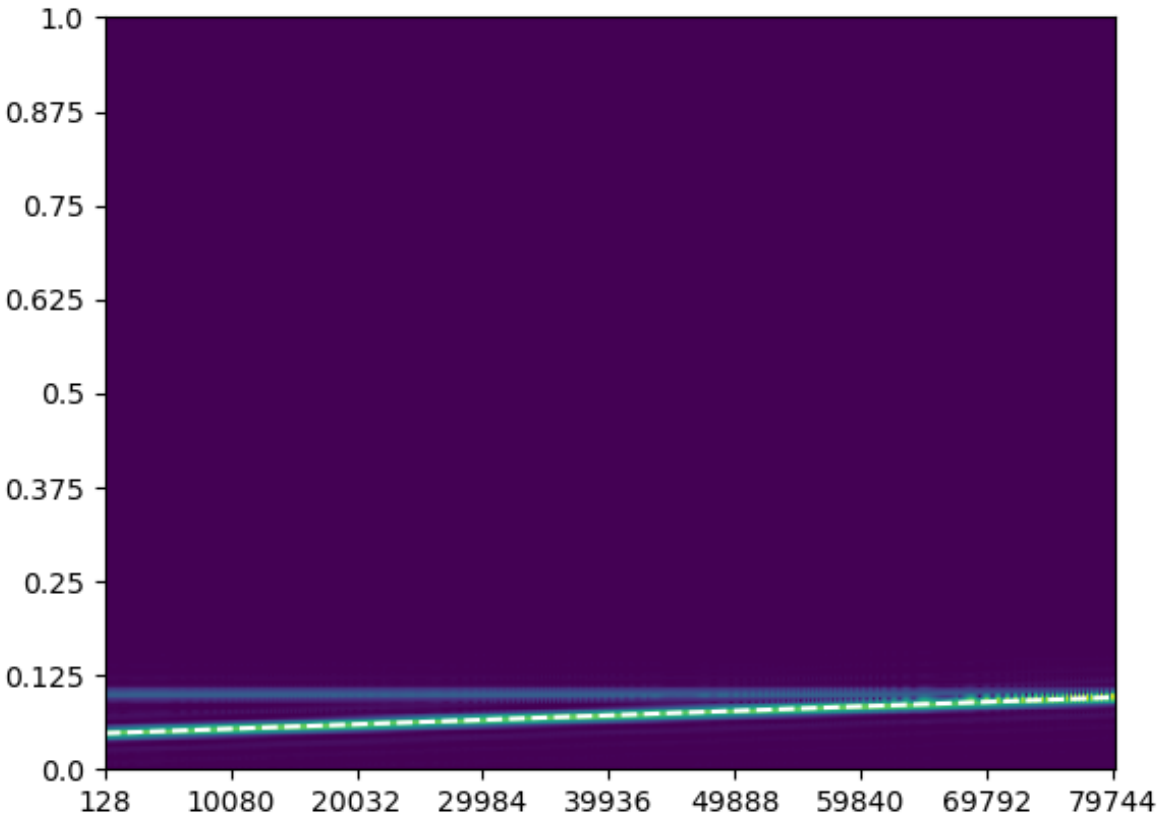
In [5]:
```
XB = stft(x, M, M-R; nfft = N, onesided = false, window = wB, fs =
fa)

#axim=imshow(abs.(XB[1:(N÷2),:]), aspect = size(XB)[2]/N, cmap = Co
lorMap("viridis"), origin = "lower")
#specgram(x, Fs = fa, window = wB, scale = "linear", NFFT = M, nove
rlap = M-R, pad_to = N, mode = "magnitude"); # scale = "linear" use
NFFT = M para usar a janela default
ax=pcolormesh(abs.(XB[1:(N÷2),:]));
yticks(0:64:512,(0:64:512)*fa/N);
#xticks(0:2500:size(XB)[2]-1, (0:2500:size(XB)[2]-1)*R);
# size(XB)[2]*R+(M-R)
```



In [77]:
```
ft = (Ω0 .+ ΔΩ * t)/(2π);
size(XB)
```

Out[77]:
```
(1024, 2493)
```

In [136]:
```
plota_stft(XB[1:(N÷2)+1,:], M, R)
especplot(t[128:end-128], ft[128:end-128], (M-1)÷2, R, size(XB)[1],
(N÷2)+1, fa; col= "w--");
```



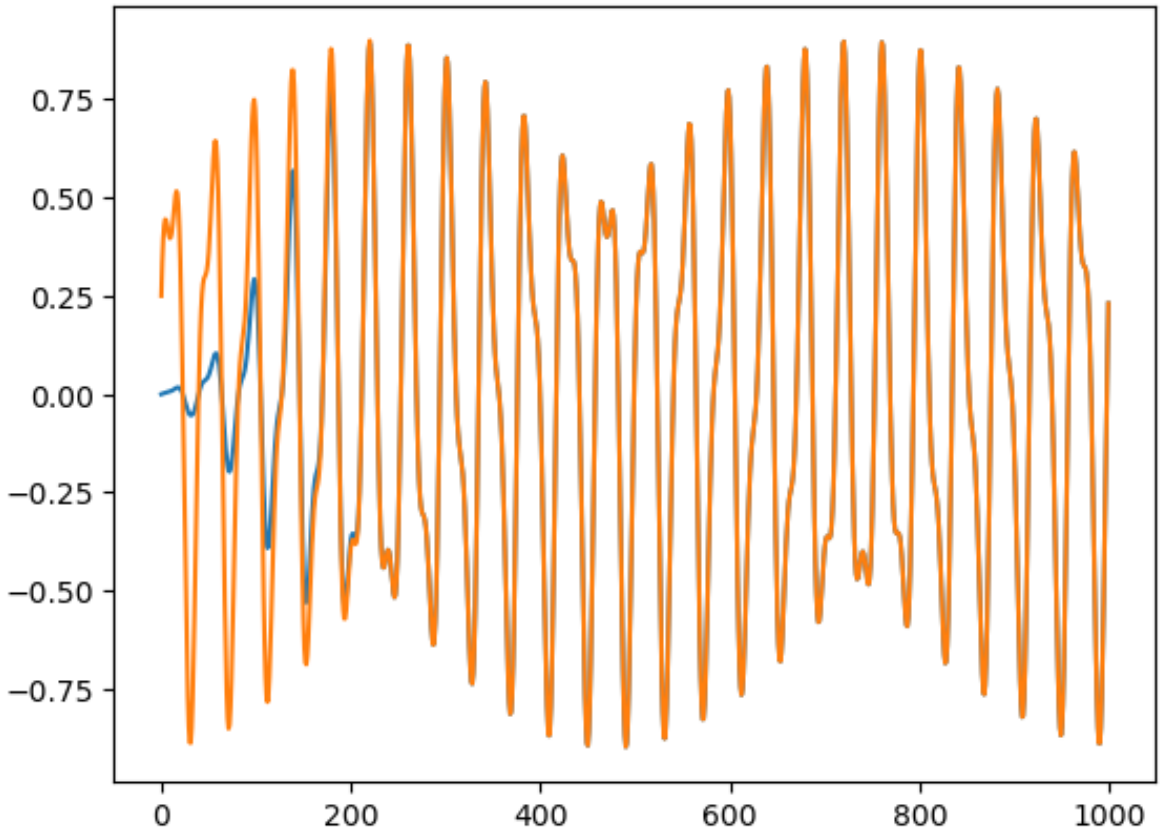
In [6]:
```
xB = istft(XB, R, Q÷2);
```

In [7]:
```
xBb = SampleBuf(xB, fa)
```

Out[7]:

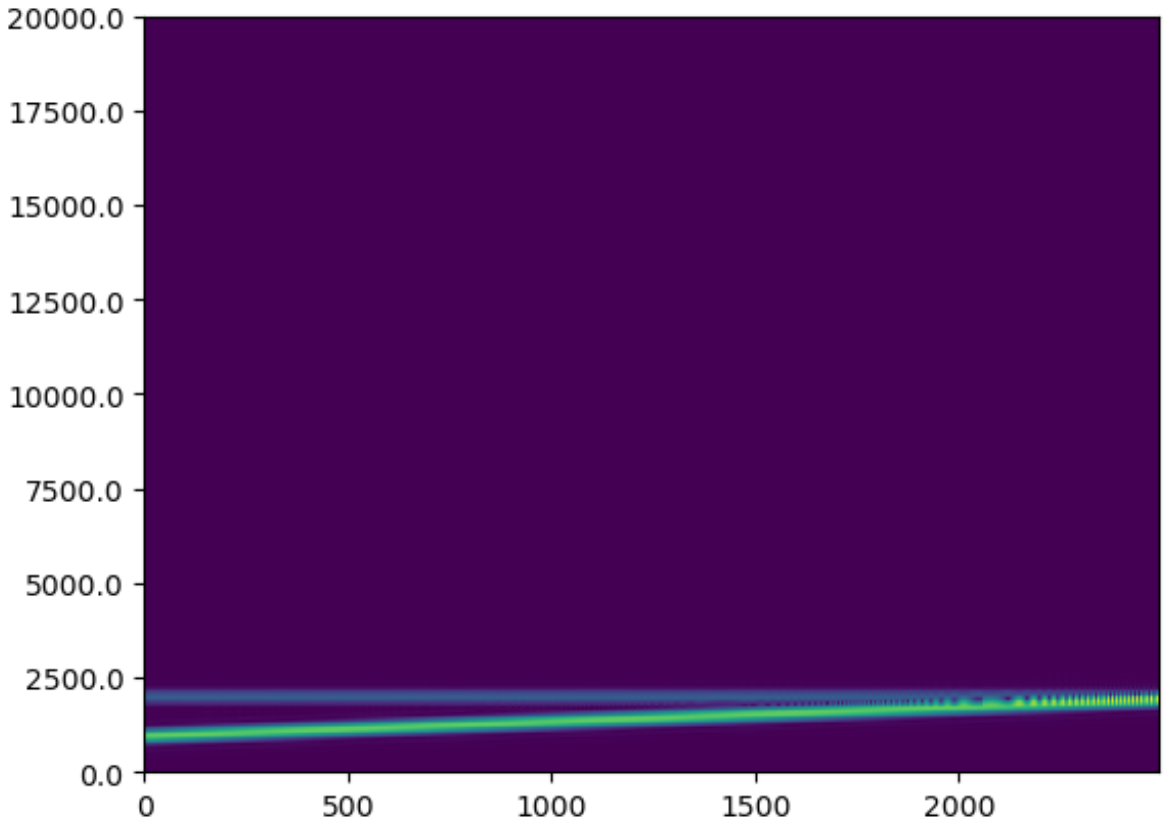
-0:02

In [31]:
```
plot(xB[1:1000])
plot(x[1:1000]);
#plot(x-xB[1:length(x)])
```



Janela de von Hann (hanning)

In [9]:
```
XHn = stft(x, M, M-R; nfft = N, onesided = false, window = wHn, fs
= fa)

#axim=imshow(abs.(XB[1:(N÷2),:]), aspect = size(XB)[2]/N, cmap = Co
lorMap("viridis"), origin = "lower")
#specgram(x, Fs = fa, window = wB, scale = "linear", NFFT = M, nove
rlap = M-R, pad_to = N, mode = "magnitude"); # scale = "linear" use
NFFT = M para usar a janela default
ax=pcolormesh(abs.(XHn[1:(N÷2),:]));
yticks(0:64:512,(0:64:512)*fa/N);
#xticks(0:2500:size(XHn)[2]-1, (0:2500:size(XHn)[2]-1)*R);
# size(XB)[2]*R+(M-R)
```



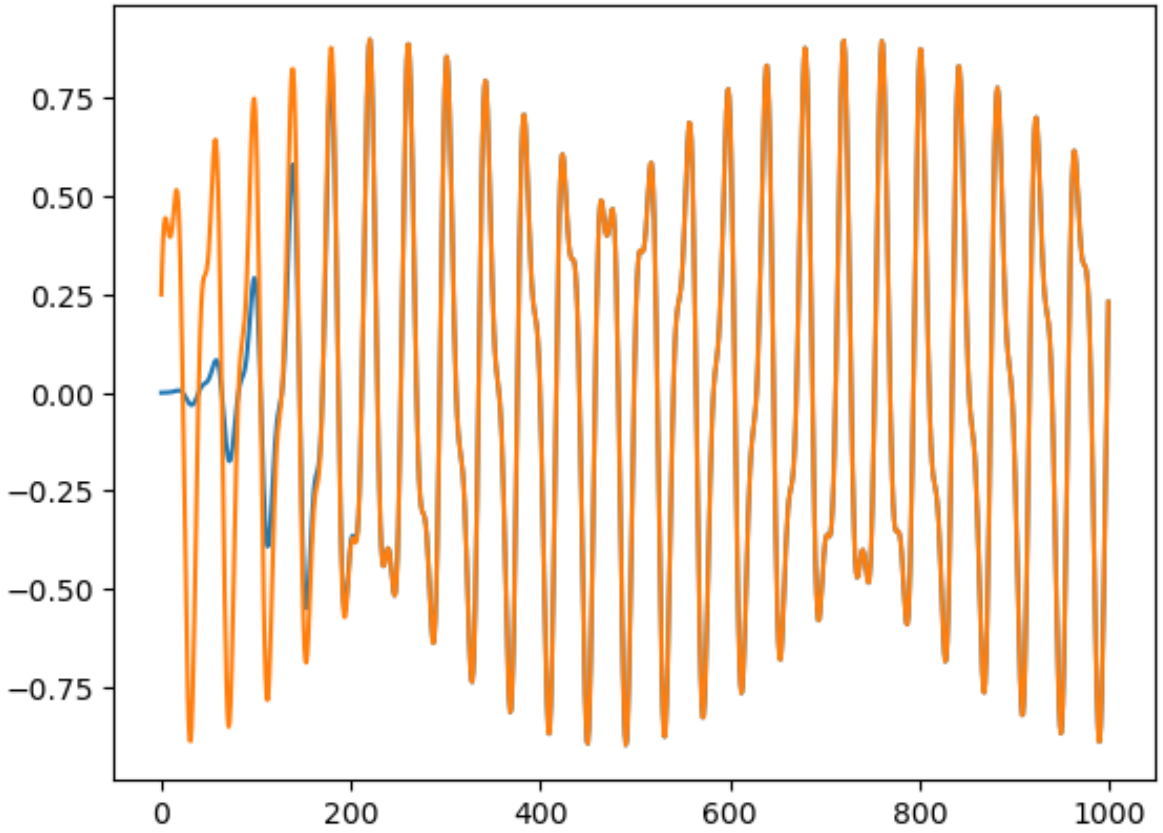
In [10]:
```
xHn = istft(XHn, R, Q÷2);
```

In [11]:
```
xHnb = SampleBuf(xHn, fa)
```

Out[11]:

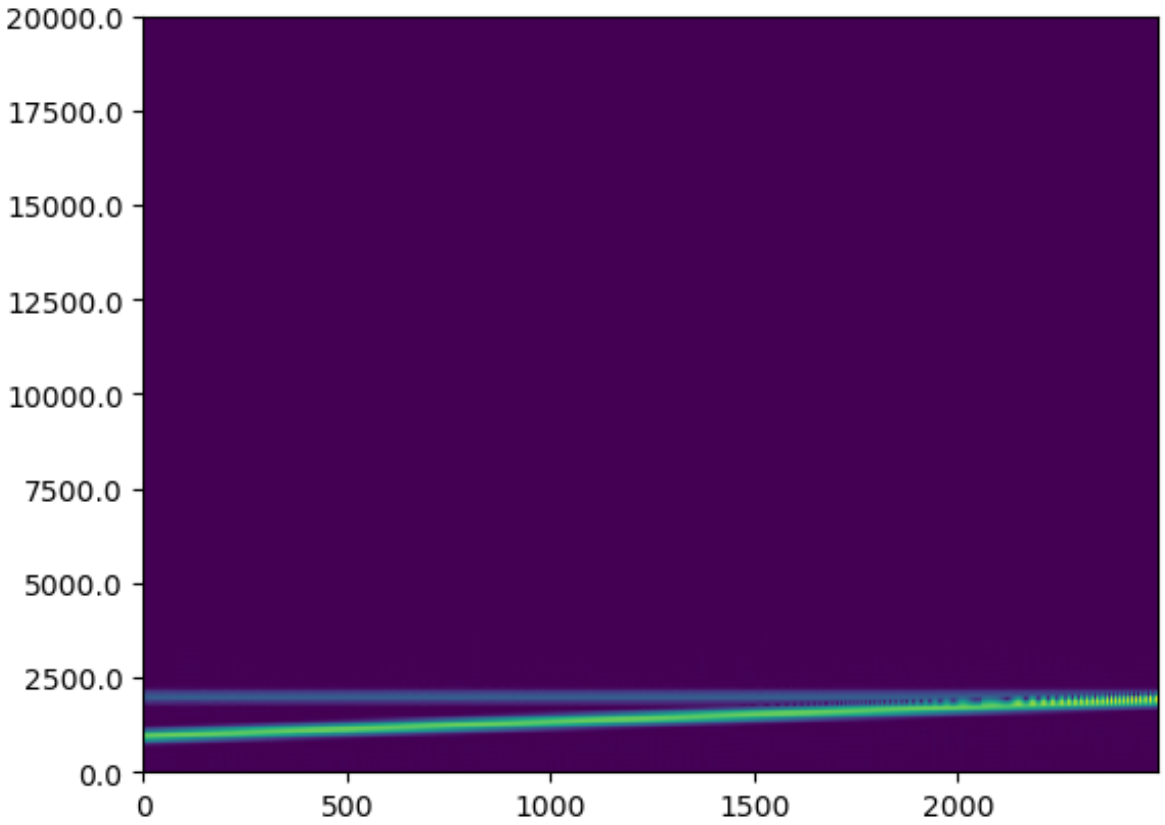
-0:02

In [12]:
```
plot(xHn[1:1000])
plot(x[1:1000]);
```



Janela de Hamming

In [13]:
```
XH = stft(x, M, M-R; nfft = N, onesided = false, window = wH, fs =
fa)

#axim=imshow(abs.(XB[1:(N÷2),:]), aspect = size(XB)[2]/N, cmap = Co
lorMap("viridis"), origin = "lower")
#specgram(x, Fs = fa, window = wB, scale = "linear", NFFT = M, nove
rlap = M-R, pad_to = N, mode = "magnitude"); # scale = "linear" use
NFFT = M para usar a janela default
ax=pcolormesh(abs.(XH[1:(N÷2),:]));
yticks(0:64:512,(0:64:512)*fa/N);
#xticks(0:2500:size(XH)[2]-1, (0:2500:size(XH)[2]-1)*R);
# size(XB)[2]*R+(M-R)
```



In [14]:
```
xH = istft(XH, R, (Q÷2));
```

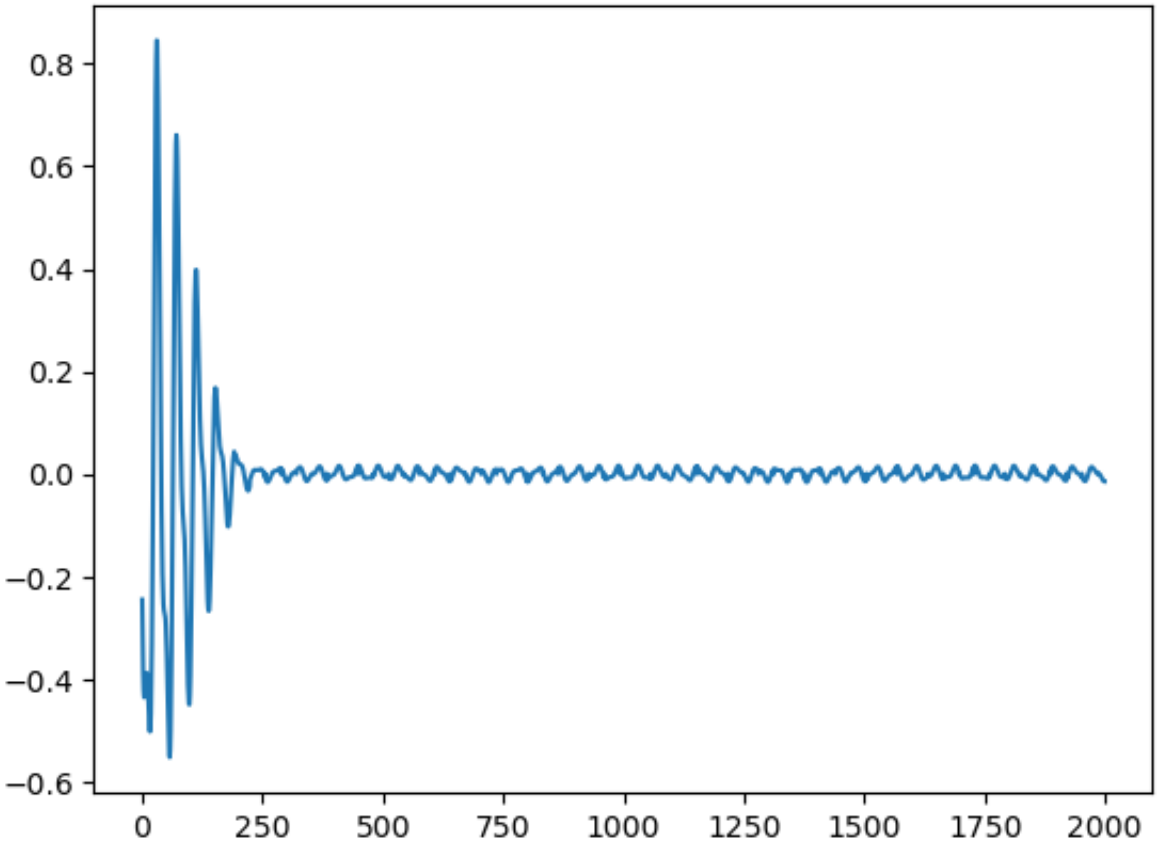
In [15]:
```
xH = xH * maximum(x)/maximum(xH);
```

In [16]:
```
xHb = SampleBuf(xH, fa)
```

Out[16]:

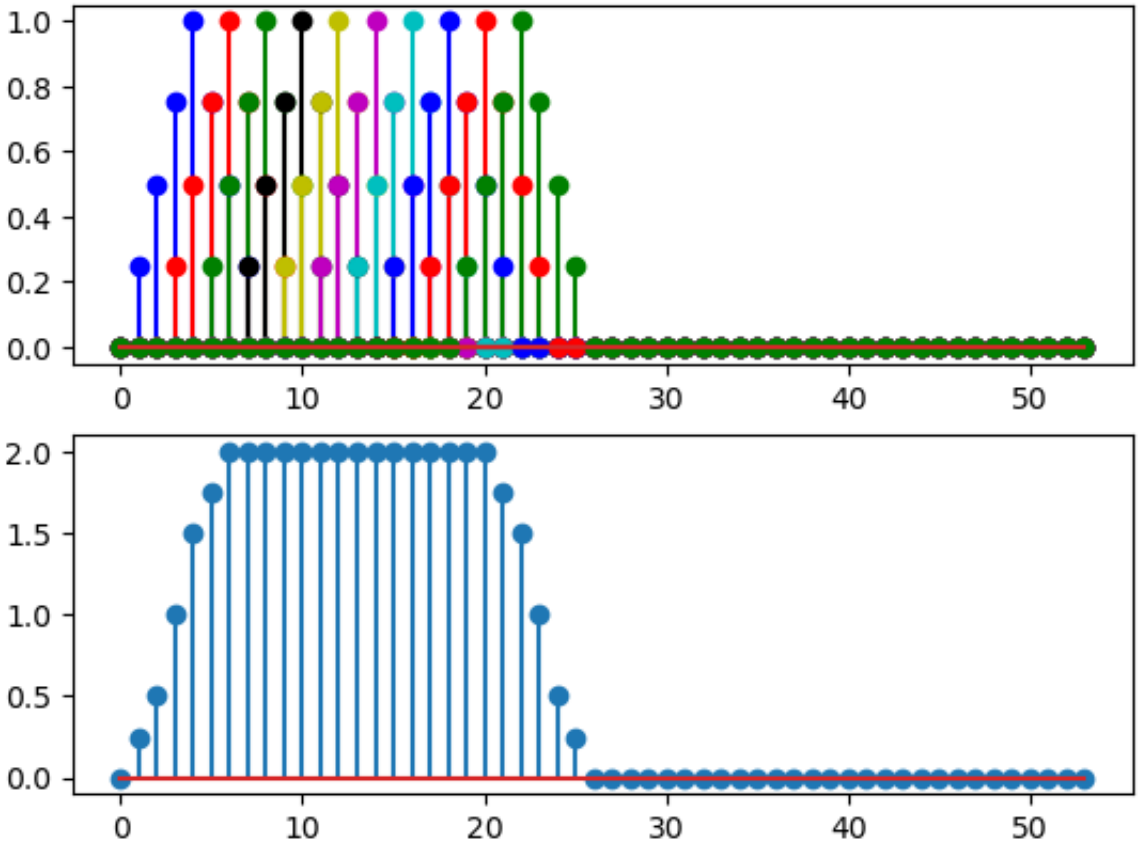
-0:02

In [17]:
```
plot(xH[1:2000]-x[1:2000]);
```



Somas das janelas

In [47]:
```
figure();clf()
M1 = 9
R1 = (M1-1)÷4
wsoma = zeros(6*M1)
w = bartlett(M1)
K = 10
color=["b","r","g","k","y","m","c"]
color=repeat(color,3)
for k in 1:K
    subplot(211)
    wparcelas = zeros(6*M1)
    wparcelas[(k-1)*R1+1:(k-1)*R1+M1] .= w
    stem(0:length(wparcelas)-1,wparcelas,color[k],markerfmt="o"*col
or[k])
    wsoma[(k-1)*R1+1:(k-1)*R1+M1] .+= w

end
subplot(212)
stem(wsoma);
```



In [35]:
```
janelakaiser(2π*220/16000,40)
```

Out[35]:
```
([0.023815318297024688, 0.026312187655465034, 0.02891930528797404,
0.031638312734343234, 0.03447079901067382, 0.03741829841287675, 0.
04048228834503641, 0.04366418717501809, 0.046965352119691245, 0.05
038707716212463  …  0.05038707716212463, 0.046965352119691245, 0.0
4366418717501809, 0.04048228834503641, 0.03741829841287675, 0.0344
7079901067382, 0.031638312734343234, 0.02891930528797404, 0.026312
187655465034, 0.023815318297024688], 5.481577671231781)
```

Janela retangular

In [ ]:
```
figure();clf()
M1 = 8
R1 = M1÷2 #(M1-1)÷4
wsoma = zeros(8*M1)
w = ones(M1)
K = 10
color=["b","r","g","k","y","m","c"]
color=repeat(color,3)
for k in 1:K
    subplot(211)
    wparcelas = zeros(8*M1)
    wparcelas[(k-1)*R1+1:(k-1)*R1+M1] .= w
    stem(0:length(wparcelas)-1,wparcelas,color[k],markerfmt="o"*col
or[k])
    wsoma[(k-1)*R1+1:(k-1)*R1+M1] .+= w

end
subplot(212)
stem(wsoma);
```