EE115 Lab 4

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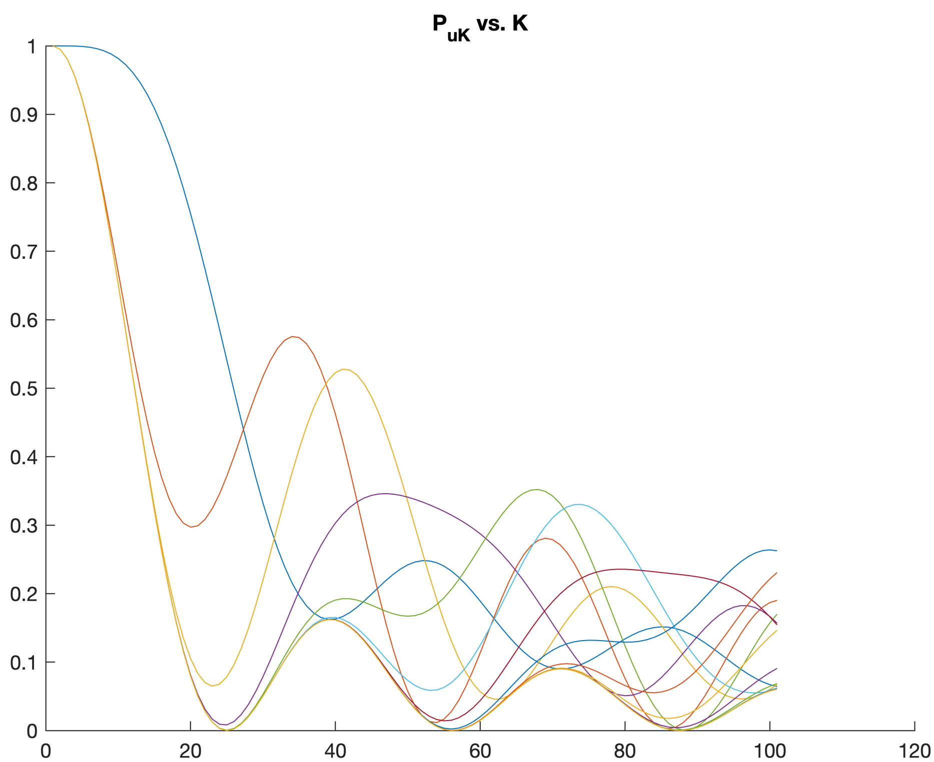
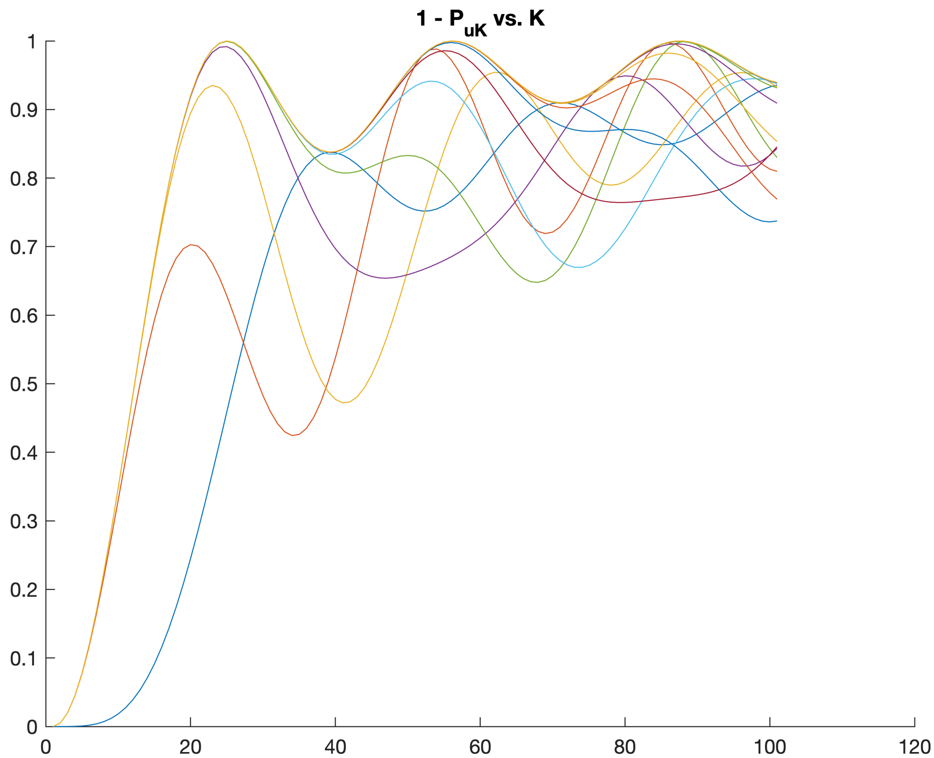
1. Compute and plot "P_{uK} versus K" and "1 - P_{uK} versus K" for various β

```
clf
%various beta
beta = 0:0.1:10;
K = 100;
n = 1:1:K+1;
uK_t = besselj(0,beta);
% For Loop
for i = n
    value = besselj(i,beta);
    P_uk = uK_t.^2 + 2*(value.^2);
    hold on
    plot(n, P_uk)
end
title('P_{uK} vs. K')
hold off
```




```
figure
```

```
for i = n
    value = besselj(i,beta);
    P_uk = uK_t.^2 + 2*(value.^2);
    P_uK = 1 - P_uk;
    hold on
    plot(n, P_uK)
end
title('1 - P_{uK} vs. K')
```



1. Explain why 1 - P_{uK} is the poower of the error function $u(t) - u_K(t)$

The total power of $u(t)$, which is the complex envelope of $u_{\mathrm{FM}}(t)$, is equal to 1. The limit, as K approaches infinity, of the fourier series expansion of $u_K(t)$ is also one. Therefore, the total power minus the power of various integer multiples of the same complex envelope (given the condition that we neglect all orders when $|n| > K$) gives us the error function $u(t) - u_K(t)$.

2. Explain why the bandwidth of $u(t)$ is approximately equal to $B_m = f_m(\beta + 1)$.

The bandwidth of $u(t) = B_u$ if $J_n(\beta)$ for $|n| > K$ can all be neglected. $B_u = \mathrm{K}\mathrm{f}_m = \mathrm{K}\mathrm{B}_m$. Performing algebra we get $B_m = f_m$. This leaves us with the equation $W = 2f_m(\beta + 1)$. Since we are only interested in the positive values of spectrum, we divide the bandwidth by 2. Therefore, the bandwidth of $u(t) = f_m(\beta + 1)$.