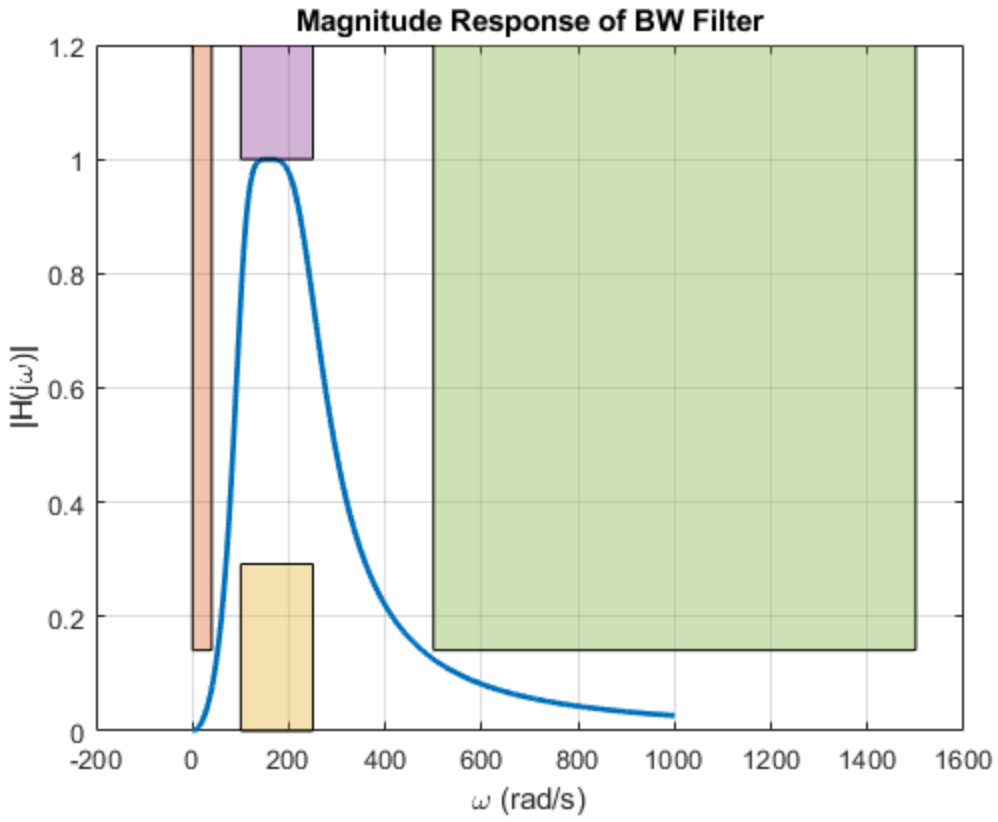
BP Design

BP characteristics in terms of LP

```
wp=1; wp1=100; wp2=250; ws1=40; ws2=500;
ws = abs([ wp*(ws1^2 - wp1*wp2)/(ws1*(wp2-wp1)),...
    wp*(ws2^2 - wp1*wp2)/(ws2*(wp2-wp1)) ]);
ws = min(ws); ap=3; as=17;

% Design LP prototype
p = @(k,K,wc) 1j*wc*exp((1j*pi/(2*K))*((2*k-1)));
K = @(wp, ap, ws, as) ceil( log( (10^(as/10)- 1) / (10^(ap/10)-1) ) /
 (2*log(ws/wp)) );
wc_range = @(wp,ap,ws,as, K) [ (wp/(10^(ap/10)-1)^(1/(2*K))) (ws/
(10^(as/10)-1)^(1/(2*K))) ];
order = K(wp,ap,ws,as)
omegac_range = wc_range(wp,ap,ws,as,order)
wc = (omegac_range(1) + omegac_range(2)) / 2;
k = 1:order;
poles_p = p(k,order,wc)
A = poly(poles_p)

% Now transform
a = 1; b = -poles_p*(wp2-wp1); c = wp1*wp2;
poles = [ (-b + sqrt(b.^2 - 4*a*c))/(2*a),  (-b - sqrt(b.^2 - 4*a*c))/
(2*a) ]
B = (wc^order)*((wp2-wp1)^order)*poly(zeros(order,1)), A = poly(poles)

delta_p = 10^(-ap/20); delta_s = 10^(-as/20);
w = 0:2*ws2; H = polyval(B, 1j*w) ./ polyval(A,1j*w);
plot(w, abs(H), 'LineWidth', 2);
pgon1 = polyshape([0 ws1 ws1 0], [delta_s delta_s 2 2]);
pgon2 = polyshape([wp1 wp1 wp2 wp2], [1-delta_p 0 0 1-delta_p]);
pgon3 = polyshape([wp1 wp1 wp2 wp2], [1 2 2 1]);
pgon4 = polyshape([ws2 ws2 3*ws2 3*ws2], [delta_s 2 2 delta_s]);
hold on;
plot(pgon1);
plot(pgon2);
plot(pgon3);
plot(pgon4);
hold off;
grid on;
xlabel('\omega (rad/s)'), ylabel('|H(j\omega)|'), title('Magnitude
 Response of BW Filter');
ylim([0 1.2]);
```

```
order =

     2


omegac_range =
```

```
    1.0012    1.1332


poles_p =

  -0.7546 + 0.7546i  -0.7546 - 0.7546i


A =

   1.0000 + 0.0000i   1.5092 - 0.0000i   1.1389 - 0.0000i


poles =

   1.0e+02 *

  -0.3650 - 1.0279i  -0.3650 + 1.0279i  -0.7669 + 2.1598i  -0.7669 -
 2.1598i


B =

   1.0e+04 *

    2.5625         0         0


A =

   1.0e+08 *

  Columns 1 through 4

   0.0000 + 0.0000i   0.0000 - 0.0000i   0.0008 - 0.0000i   0.0566 -
 0.0000i

  Column 5

   6.2500 + 0.0000i
```



LP Design

```
p = @(k,K,wc) 1j*wc*exp((1j*pi/(2*K))*((2*k-1)));

wp=10; ap=2; ws=30; as=20; K = @(wp, ap, ws, as) ceil( log( (10^(as/10)- 1) / (10^(ap/10)-1) ) / (2*log(ws/wp)) ); wc_range = @(wp,ap,ws,as, K) [ (wp/(10^(ap/10)-1)^(1/(2*K))) (ws/(10^(as/10)-1)^(1/(2*K))) ]; order = K(wp,ap,ws,as) wc_range(wp,ap,ws,as,order)

wc = 12.5; k = 1:order; poles = p(k,order,wc) A = poly(poles)

delta_p = 10^(-ap/20); delta_s = 10^(-as/20); w = 0:100; H = wc^order ./ (polyval(A, 1j*w)); plot(w, abs(H), 'LineWidth', 2); pgon1 = polyshape([0 wp wp 0], [0 0 delta_p delta_p]); pgon2 = polyshape([0 wp wp 0], [1 1 2 2]); pgon3 = polyshape([ws ws 3*ws 3*ws], [delta_s 2 2 delta_s]); hold on; plot(pgon1); plot(pgon2); plot(pgon3); hold off; grid on; xlabel('\omega (rad/s)'), ylabel('|H(j\omega)|'), title('Magnitude Response of BW Filter'); ylim([0 1.2]);
```

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