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```
%/home/chuck/Documents/working/12521/slides/cascadeamp.m
% Thu Sep 19 12:24:16 2024
R1=1000;R2=20000;R3=1000;R4=20000;
gbp=10e6; % Gain-Bandwidth Product
f=10.^[0:0.01:8]; % Frequency axis
```

Two Stage Amplifier

Stage 1

```
AaOL=-R2/R1
fa=gbp/abs(AaOL)
Aa=AaOL./(1+1j*f/fa);

% Stage 2
AbOL=-R4/R3
fb=gbp/abs(AbOL)
Ab=AbOL./(1+1j*f/fb);
```

```
AaOL =
   -20
fa =
      500000
AbOL =
   -20
fb =
      500000
```

Single Stage with Same Gain to Compare

```
AcOL=AaOL*AbOL
fc=gbp/abs(AcOL) % Same gbp
Ac=AcOL./(1+1j*f/fc);

fig1=figure;semilogx(f,20*log10(abs(Aa)),'b-',...
    f,20*log10(abs(Ab)),'g--',...
    f,20*log10(abs(Aa.*Ab)),'r-',...
    f,20*log10(abs(Ac)),'c--');grid on;
xlabel('f, Frequency, Hz');ylabel('|A|, Gain, dB');

fig2=figure;semilogx(f,(angle(Aa)*180/pi),'b-',...
```

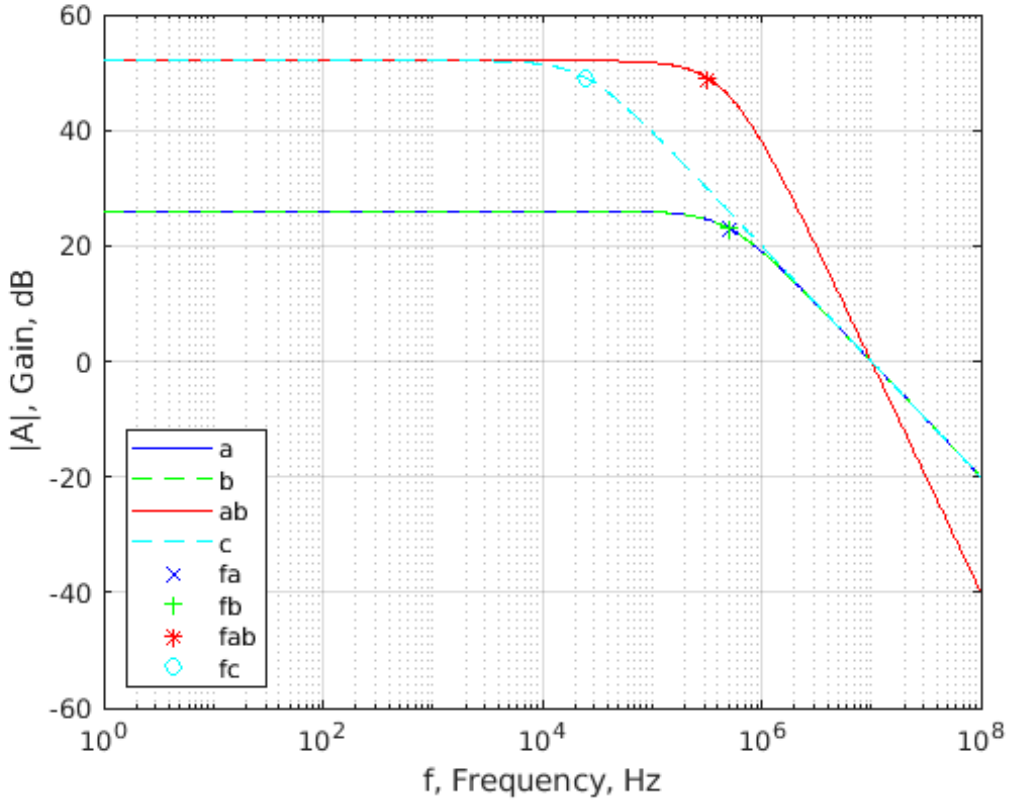
```
    f,(angle(Ab)*180/pi),'g--',...
    f,(angle(Aa.*Ab)*180/pi),'r-',...
    f,(angle(Ac)*180/pi),'c--');grid on;
xlabel('f, Frequency, Hz');ylabel('angle(A), Phase, deg.');
legend('a','b','ab','c','Location','SouthWest');

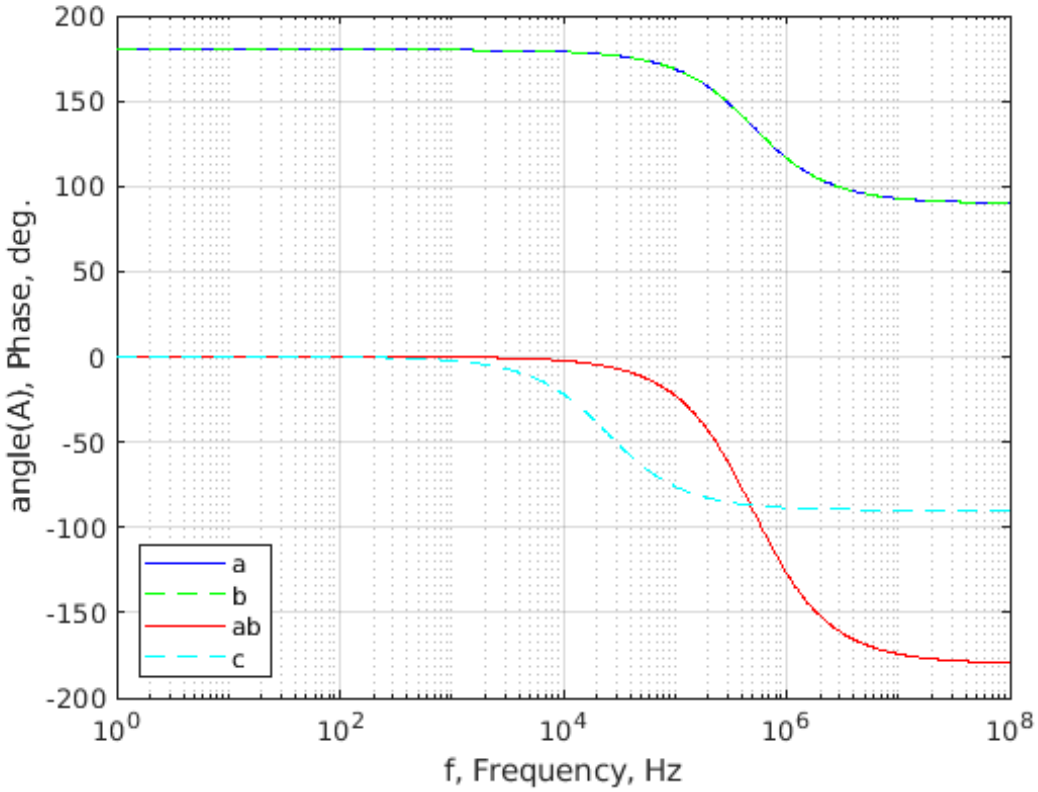
test=find(abs(Aa.*Ab)<abs(AaOL*AbOL)/sqrt(2),1);
fs=f(test)

figure(fig1);
hold on;
semilogx(fa,20*log10(abs(AaOL)/sqrt(2)),'bx',...
    fb,20*log10(abs(AbOL/sqrt(2))),'g+',...
    fs,20*log10(abs(AaOL.*AbOL)/sqrt(2)),'r*',...
    fc,20*log10(abs(AcOL/sqrt(2))),'co');grid on;
hold off;
legend('a','b','ab','c','fa','fb','fab','fc','Location','SouthWest');

figure(fig2);

AcOL =
   400
fc =
        25000
fs =
   3.2359e+05
```





Discussion

```
% The cutoff frequency of the cascaded amplifier is lower than that of
% either stage separately.

% The cutoff frequency of the cascaded amplifier is higher than that
% of the single stage with the same gain.

% The transfer function of the cascaded pair falls off faster than
% that of the single stage with the same gain. (40dB/decade)
```

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