Introductory Control Systems
Exercises #15 – Bode Magnitude Diagrams Answers

Note: All frequency ranges given below are ***approximate*** based on the Bode diagram sketch. The range can be found more accurately and verified using MATLAB®, for example. The estimated range is reasonably accurate in most cases.

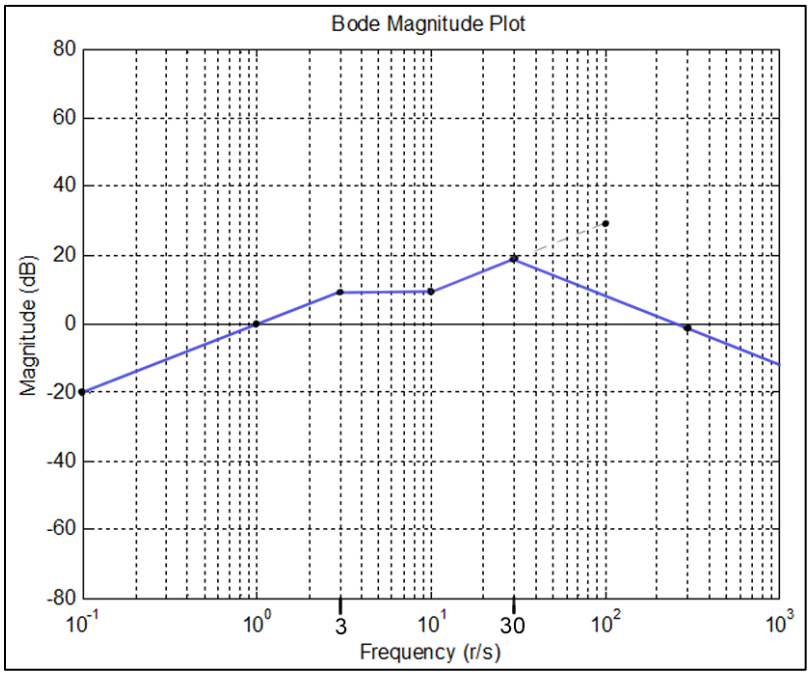
1. $$G(s)=\frac{270\,s(s+10)}{(s+3)\left(s^2+40s+900\right)}$$

System amplifies the input $(M>0\text{ dB})$:

$1<\omega<250$ (rad/s)

System attenuates the input $(M<0\text{ dB})$:

$\omega<1$ (rad/s) and $\omega>250$ (rad/s)



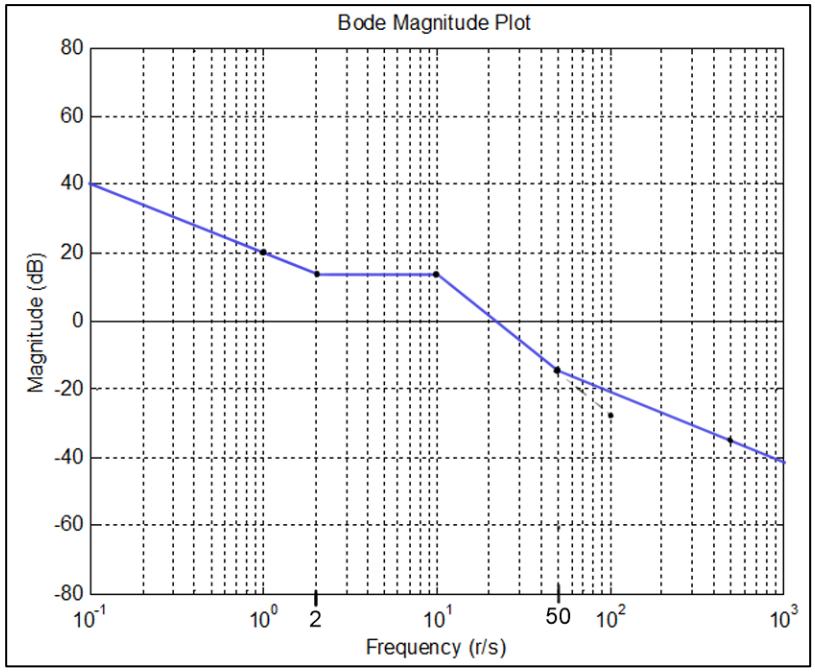
2. $$G(s)=\frac{10\,(s+2)(s+50)}{s\left(s^2+15s+100\right)}$$

System amplifies the input $(M>0\text{ dB})$:

$\omega<20$ (rad/sec)

System attenuates the input $(M<0\text{ dB})$:

$\omega>20$ (rad/s)



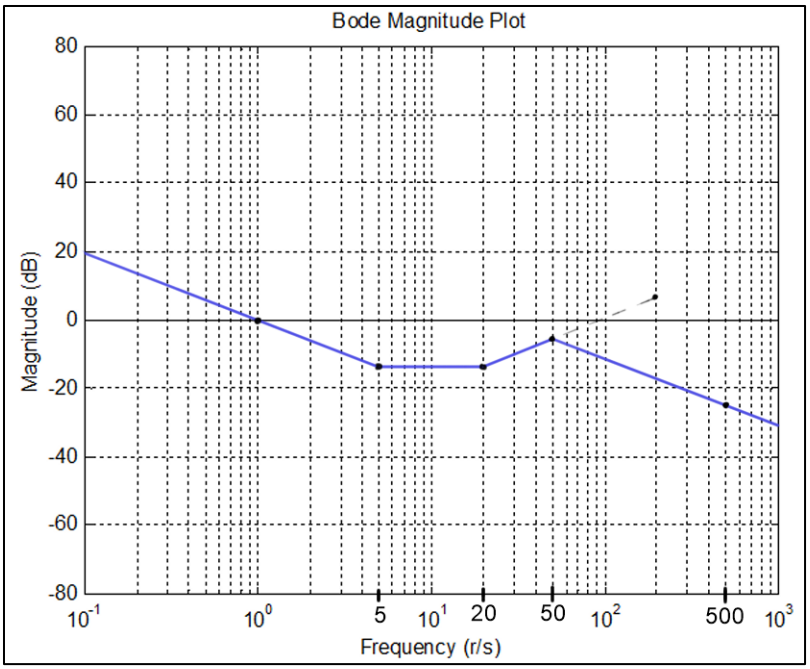
3. $$G(s) = \frac{25\,(s+5)(s+20)}{s\left(s^2 + 70s + 2500\right)}$$

System amplifies the input $(M > 0 \text{ dB})$:

$\omega < 1$ (rad/s)

System attenuates the input $(M < 0 \text{ dB})$:

$\omega > 1$ (rad/s)



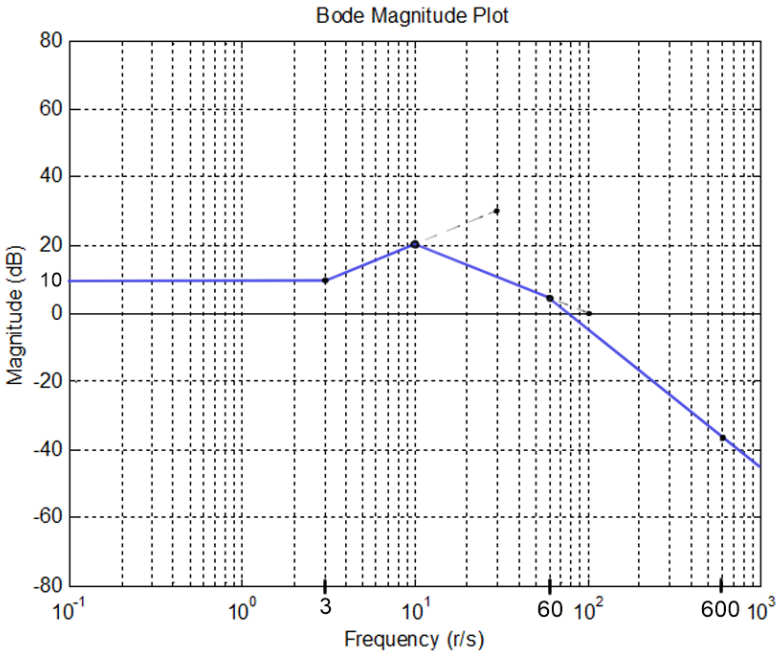
4. $$G(s) = \frac{6310\,(s+3)}{(s+60)\left(s^2 + 15s + 100\right)}$$

System amplifies the input $(M > 0 \text{ dB})$:

$\omega < 80$ (rad/s)

System attenuates the input $(M < 0 \text{ dB})$:

$\omega > 80$ (rad/s)



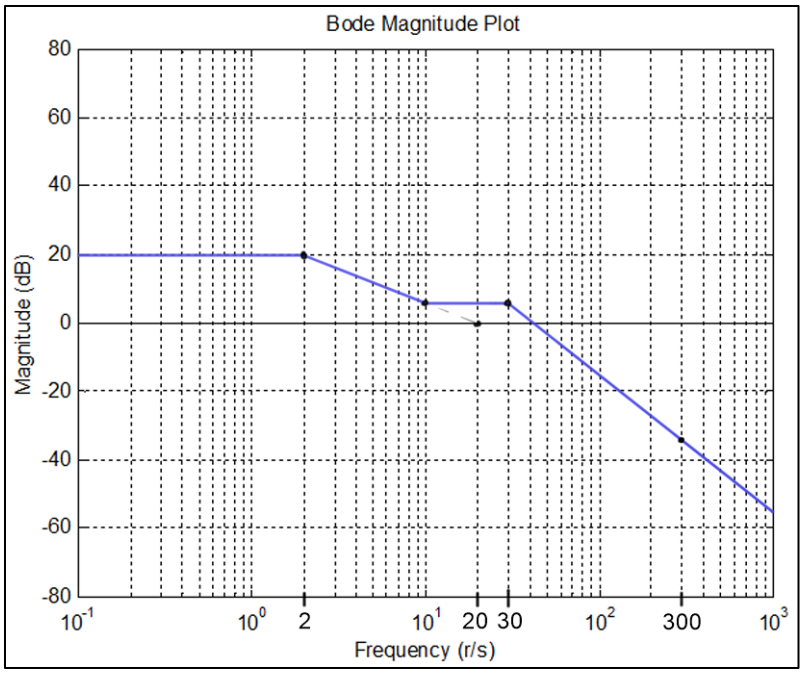
5. $$G(s)=\frac{1820(s+10)}{(s+2)(s^2+50s+900)}$$

System amplifies the input $(M>0\text{ dB})$:

$\omega<40$ (rad/s)

System attenuates the input $(M<0\text{ dB})$:

$\omega>40$ (rad/s)



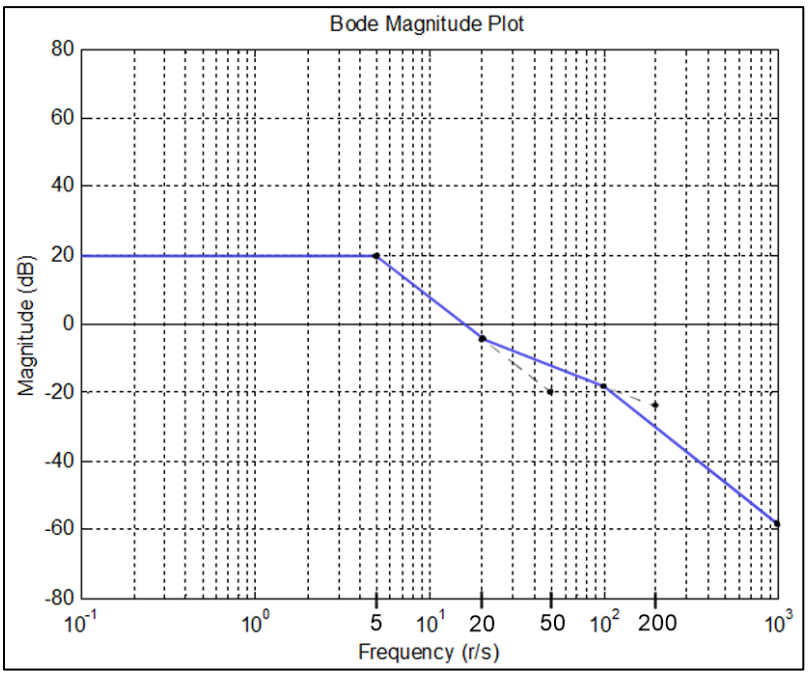
6. $$G(s)=\frac{1250(s+20)}{(s+100)(s^2+5s+25)}$$

System amplifies the input $(M>0\text{ dB})$:

$\omega<16$ (rad/s)

System attenuates the input $(M<0\text{ dB})$:

$\omega>16$ (rad/s)



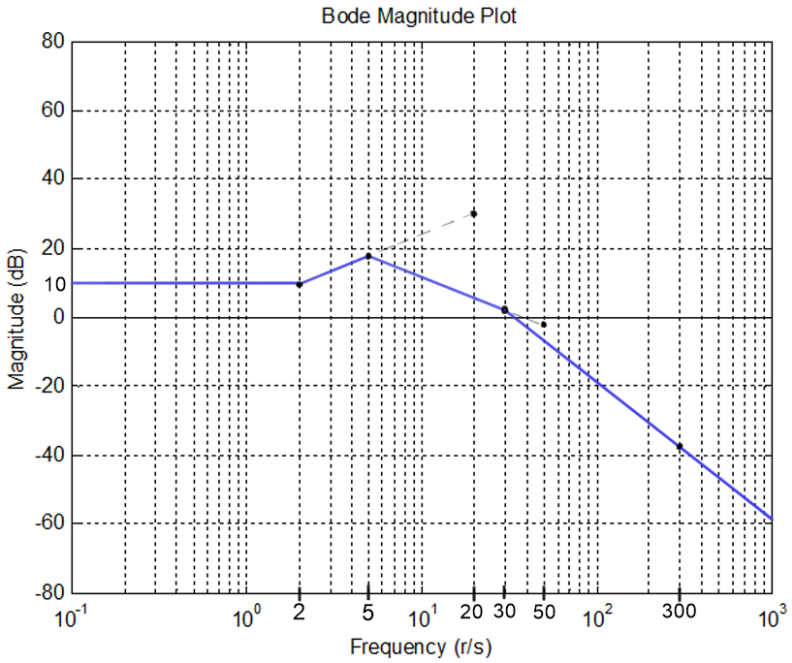
7. $$G(s)=\frac{1186(s+2)}{(s+30)(s^2+4s+25)}$$

System amplifies the input $(M>0\text{ dB})$:

$\omega<32$ (rad/sec)

System attenuates the input $(M<0\text{ dB})$:

$\omega>32$ (rad/sec)



8. $$G(s)=\frac{7906\,s}{(s+10)\left(s^2+70s+2500\right)}$$

System amplifies the input $(M>0\text{ dB})$:

$3<\omega<85$ (r/s)

System attenuates the input $(M<0\text{ dB})$:

$\omega<3$ (rad/s) and $\omega>85$ (rad/s)