PS9

By Ari Porad

Introduction to Sensors, Instrumentation, and Measurement

Note

As specified by the assignment instructions, the resistors and capacitors have the following values for all circuits:
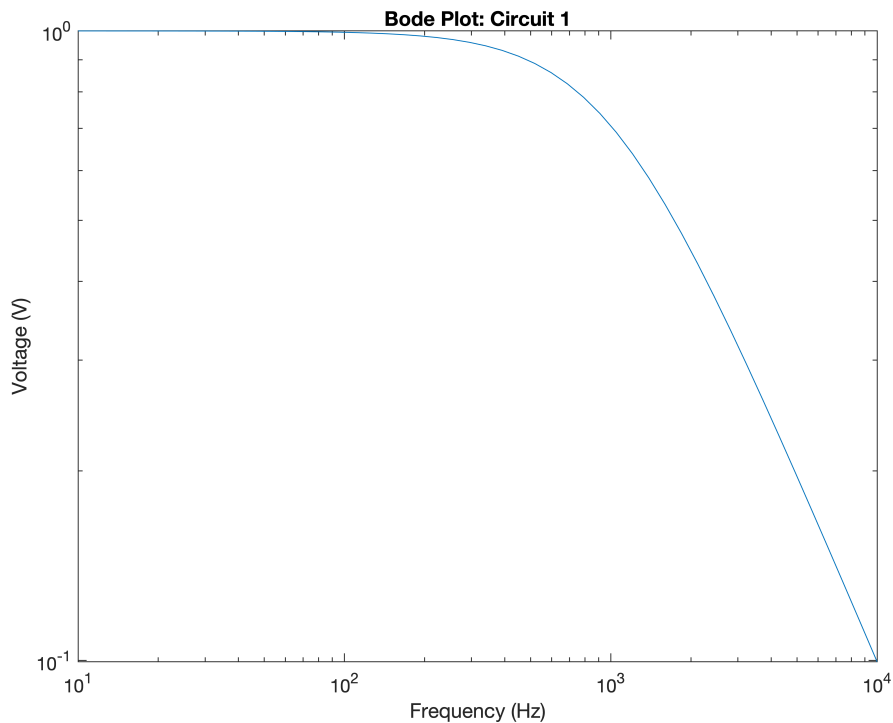
$R_1 = 1k\Omega$

$R_2 = 10k\Omega$

$C_1 = 1\mu F \ (10^{-6}\,F)$

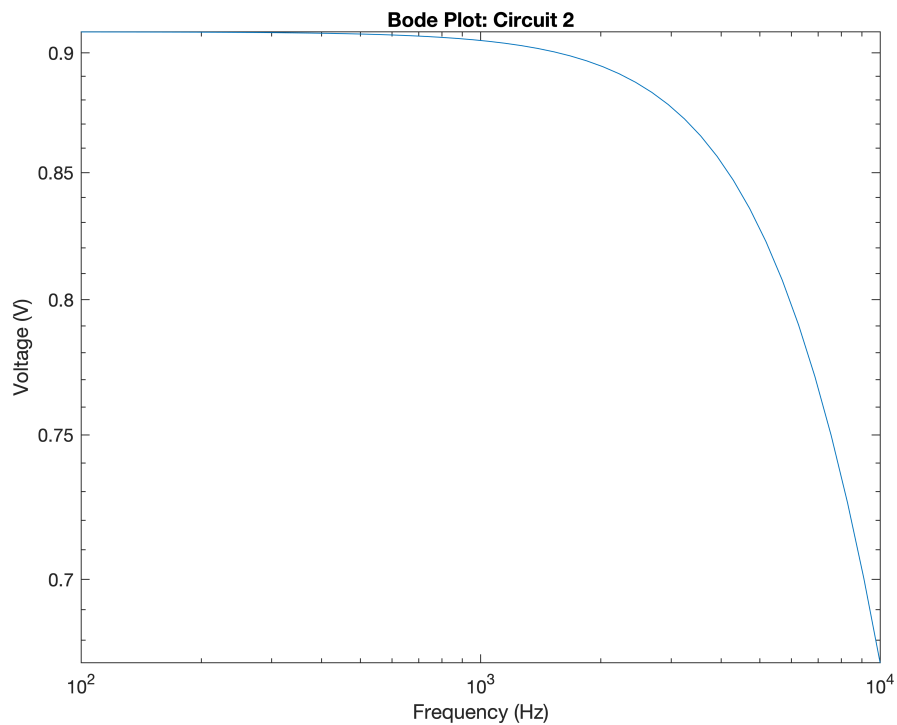$C_2 = 0.1\mu F \ (10^{-7}\,F)$

Circuit 1: RC + OpAmp

V_1 =

$$-\frac{1\,i}{C_1\,w\,\left(R_1 - \dfrac{1\,i}{C_1\,w}\right)}$$

Bode Plot: Circuit 1

Circuit 2: R + (R ∥ C) + OpAmp

V_2 =

$$\cfrac{1}{\left(\cfrac{1}{R_2}+1\,C_2\,w\,\mathrm{i}\right)\left(R_1+\cfrac{1}{\cfrac{1}{R_2}+1\,C_2\,w\,\mathrm{i}}\right)}$$

Bode Plot: Circuit 2

Circuit 3: CR + OpAmp

V_3 =

$$\frac{1\,C_1\,R_1\,w\,\mathrm{i}}{1+1\,C_1\,R_1\,w\,\mathrm{i}}$$

Bode Plot: Circuit 3
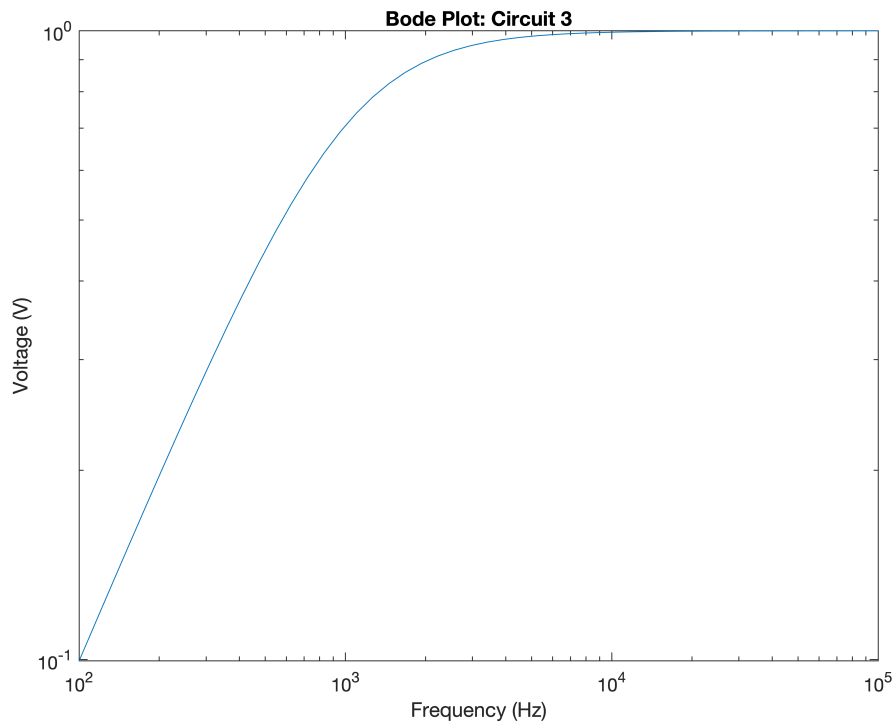
Circuit 4: R + C + (C ll R) + OpAmp

V_4 =

$$\frac{1}{\left(\dfrac{1}{R_2} + 1\,C_2\,w\,\mathrm{i}\right)\left(R_1 + \dfrac{1}{\dfrac{1}{R_2} + 1\,C_2\,w\,\mathrm{i}} - \dfrac{1\,\mathrm{i}}{C_1\,w}\right)}$$

Bode Plot: Circuit 4
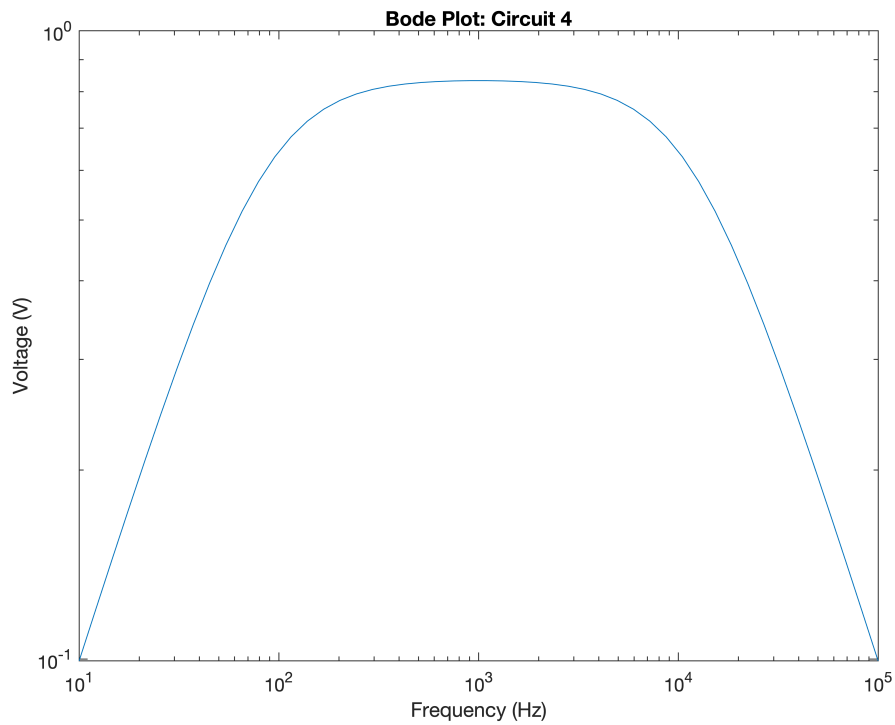
Circuit 5: RC Voltage Divider

V_5 =

$$\frac{1}{1 + 1\,C_1\,R_1\,w\,i}$$

Bode Plot: Circuit 5
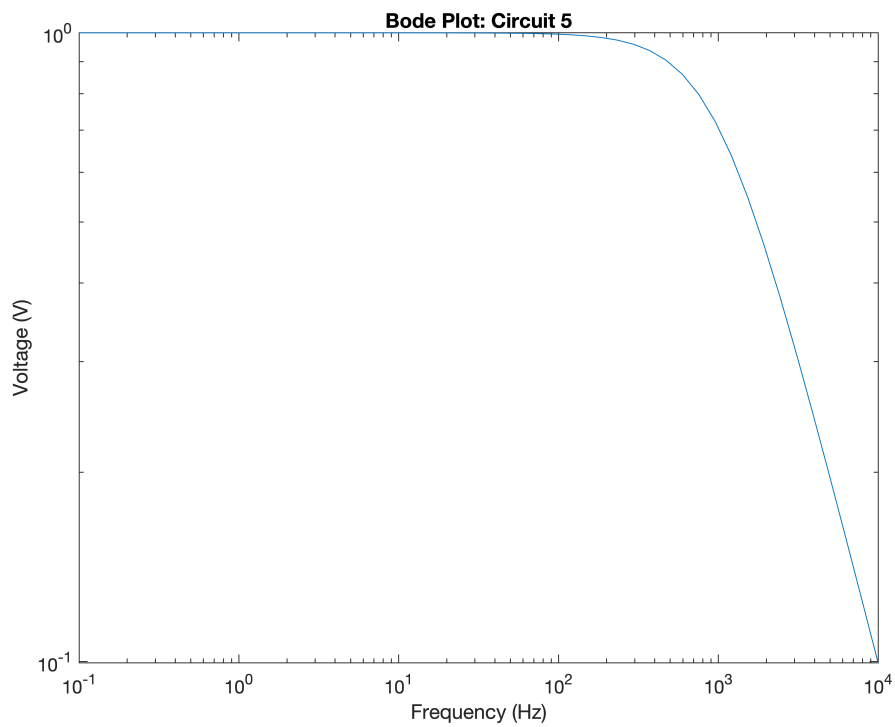
Circuit 6: RC + RC

V_6 =

$$\frac{1}{(1 + 1\, C_1\, R_1\, w\, \mathrm{i})\; (1 + 1\, C_2\, R_2\, w\, \mathrm{i})}$$

Bode Plot: Circuit 6
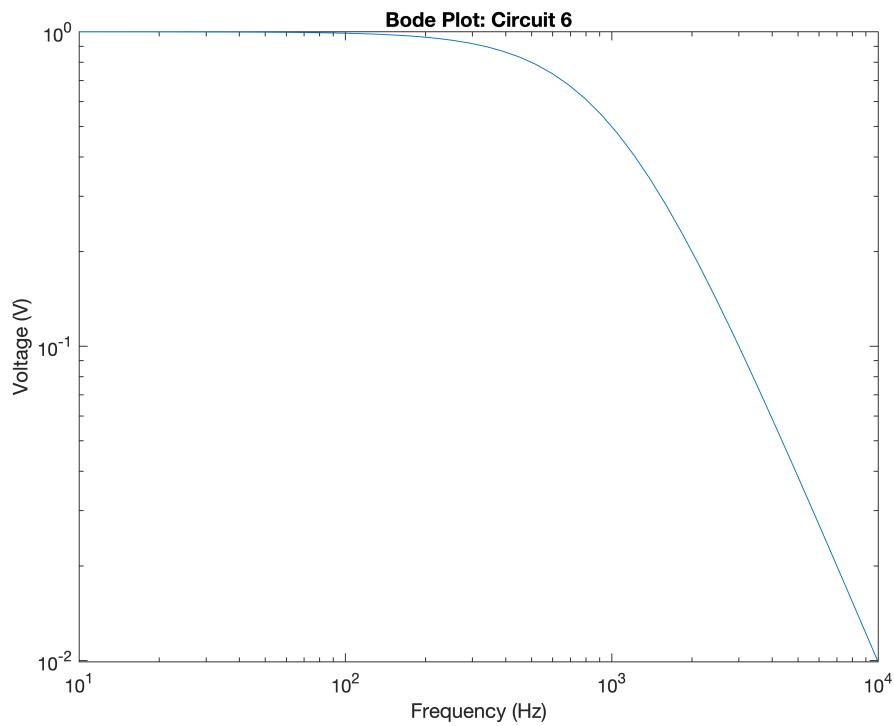
Circuit 7: RC + RC but reversed

V_7 =

$$\frac{1}{(1 + 1\, C_1\, R_1\, w\, \mathrm{i})\; (1 + 1\, C_2\, R_2\, w\, \mathrm{i})}$$

Bode Plot: Circuit 7
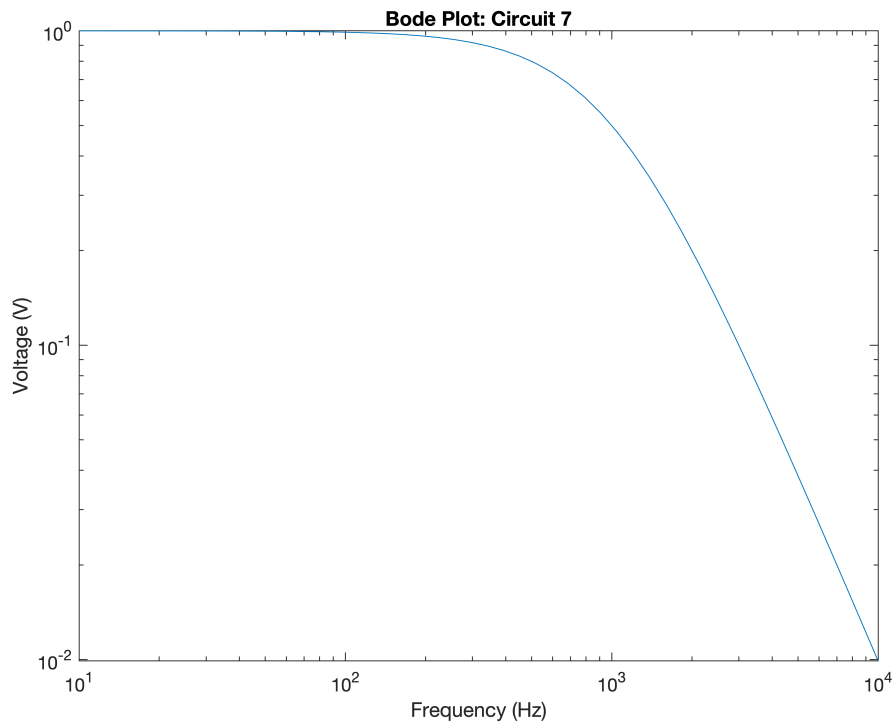
Circuit 8: RC + CR

V_8 =

$$\frac{1\,C_1\,R_1\,w\,\mathrm{i}}{(1 + 1\,C_1\,R_1\,w\,\mathrm{i})\,(1 + 1\,C_2\,R_2\,w\,\mathrm{i})}$$

Bode Plot: Circuit 8