

**Metric Prefixes**

peta	P	$10^{15}$	1 000 000 000 000 000
tera	T	$10^{12}$	1 000 000 000 000
giga	G	$10^9$	1 000 000 000
mega	M	$10^6$	1 000 000
kilo	k	$10^3$	1 000
hecto	h	$10^2$	100
deca	da	$10^1$	10
one		$10^0$	1
deci	d	$10^{-1}$	0.1
centi	c	$10^{-2}$	0.01
milli	m	$10^{-3}$	0.001
micro	$\mu$	$10^{-6}$	0.000 001
nano	n	$10^{-9}$	0.000 000 001
pico	p	$10^{-12}$	0.000 000 000 001
femto	f	$10^{-15}$	0.000 000 000 000 001

**RC Filter**

- Transmission Function:  $T(s) = \frac{V_o(s)}{V_i(s)}$
- Corner frequency: frequency  $s$  at which  $T(s) = \frac{1}{\sqrt{2}}$
- for simple circuit: ground  $\rightarrow$  source  $\rightarrow R \rightarrow C \rightarrow$  ground
  - \*  $T(s) = \frac{1}{1+RCs}$
  - $|T(j\omega)| = \frac{1}{\sqrt{1+R^2C^2s^2}}$
  - $|\angle T(j\omega)| = \frac{1}{\sqrt{1+R^2C^2s^2}}$

**Bode Plots**

- magnitude is plotted in  $dB$ :
  - $|T(j\omega)|_{dB} = 20 \log_{10} |T(j\omega)|$
- starts on y-axis at DC offset with slope 0
- just add together the bode plots of each individual pole, zero, and the DC offset
- poles always slope down, zeros slope up (applies for both magnitude and phase)
- $dec$ =decade, e.g. from  $10^0$  to  $10^1$
- magnitude:
  - \* Pole/Zero at origin:
    - constant slope  $\pm 20db/dec$  for all  $\omega$ ;  $0dB$  at  $\omega = 10^0 = 1$
  - \* Pole/Zero at  $\omega_0$ :
    - 0 for  $\omega < \omega_0$
    - slope  $\pm 20 \frac{db}{dec}$  after
  - \* Constant  $C$ : constant line at  $20 \log_{10}(|C|)$
- phase:
  - \* Pole at origin: constant  $-\frac{\pi}{2}$  or  $-90^\circ$
  - \* Zero at origin: constant  $+\frac{\pi}{2}$  or  $+90^\circ$
  - \* Pole/Zero at  $\omega_0$ :
    - 0 for  $\omega < \frac{\omega_0}{10}$
    - slope linearly ( $\pm 45^\circ/dec$ ) until  $10\omega_0$
    - 0 slope for  $\omega > 10\omega_0$
  - \* Constant  $C$ : no effect (0 for all  $\omega$ )