



Exercise 4b: Time Domain

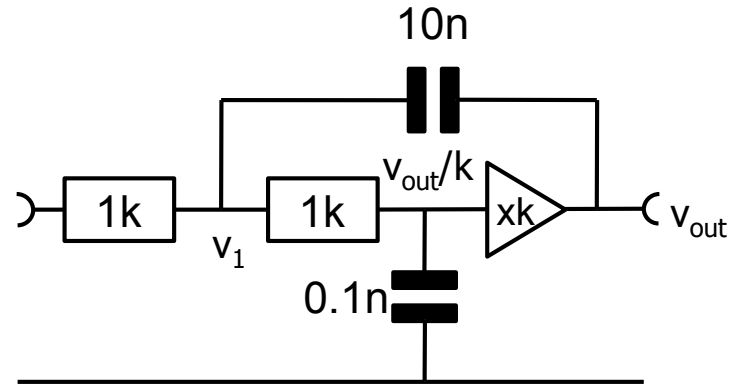
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Exercise 4b.1

- Derive $H[s]$ for the following active filter.



- For which k do you get a divergence ?
- For $k=1$, derive the step response of the circuit
- Simulate the circuit and compare quantitatively.



Solution 4b.1

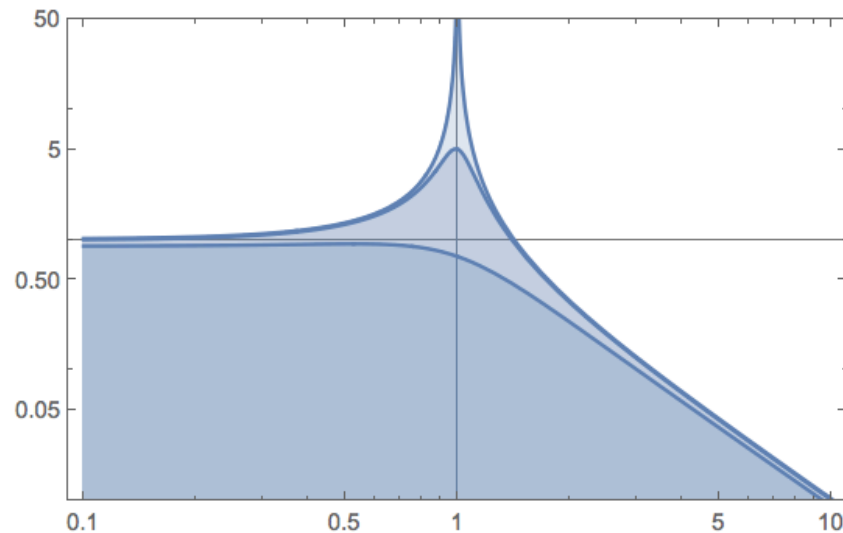
■ **Divergence:** `In[249]:= gpeak = Abs@Hactive[i, k]`

`Out[249]= 5 Abs $\left[\frac{k}{51 - 50 k} \right]$`

`In[253]:= Solve[51 - 50 k == 0, k] // N`

`Out[253]= {{k → 1.02}}`

`LogLogPlot[{Abs@Hactive[i ω, {0.9, 1, 1.02}]}, {ω, 0.1, 10},
Frame → True, PlotRange → {Full, {0.01, 50}}, Filling → Axis,
GridLinesStyle → Directive[Gray, Thin], GridLines → {{1}, {1}}]`





Solution 4b.1

■ Step Response

```
In[322]:= Step1 = InverseLaplaceTransform[ $\frac{H_{\text{active}}[s, 1]}{s}$ , s, t] // Simplify
```

$$\text{Out[322]} = 1 - e^{-t/10} \cos\left[\frac{3\sqrt{11}t}{10}\right] - \frac{e^{-t/10} \sin\left[\frac{3\sqrt{11}t}{10}\right]}{3\sqrt{11}}$$

```
In[287]:= Plot[Step1, {t, 0, 50}, PlotRange -> {0, 2}, Frame -> True, Filling -> Axis]
```

