PrakSIE-5

Gabriel SH

9/27/2021

Contents

Libraries

```
library(dplyr)
library(ggplot2)
library(patchwork)
```

Importing Data

- Read time domain data for wide bandpass filter.

```
wide_bpf_fL <- read.csv("Exports/Wide_BPF_fL.csv")
wide_bpf_fR <- read.csv("Exports/Wide_BPF_fR.csv")
wide_bpf_fH <- read.csv("Exports/Wide_BPF_fH.csv")
```

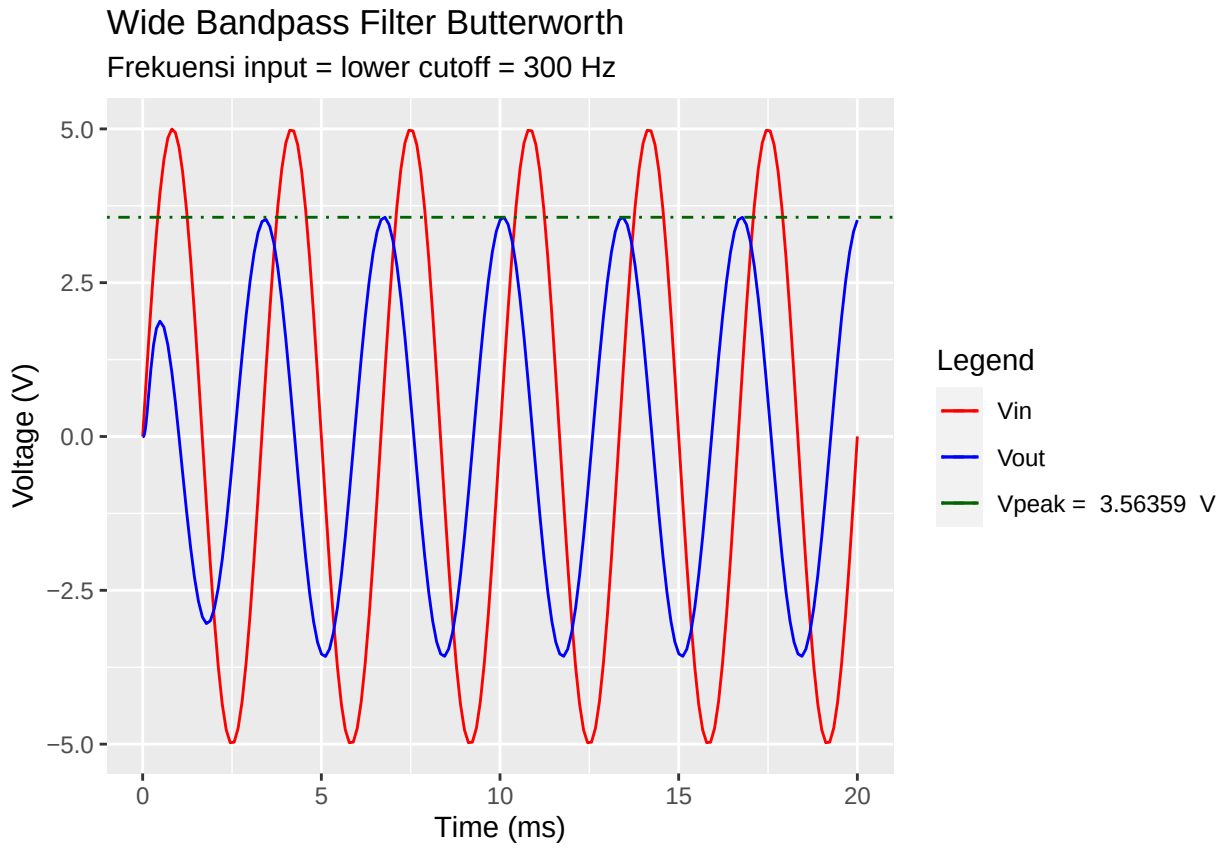
- Read time domain data for narrow bandpass filter & notch filter

```
notch_narrow_fL <- read.csv("Exports/Notch_Narrow_fL.csv")
notch_narrow_fR <- read.csv("Exports/Notch_Narrow_fR.csv")
notch_narrow_fH <- read.csv("Exports/Notch_Narrow_fH.csv")
```

5.1 Wide Bandpass Filter

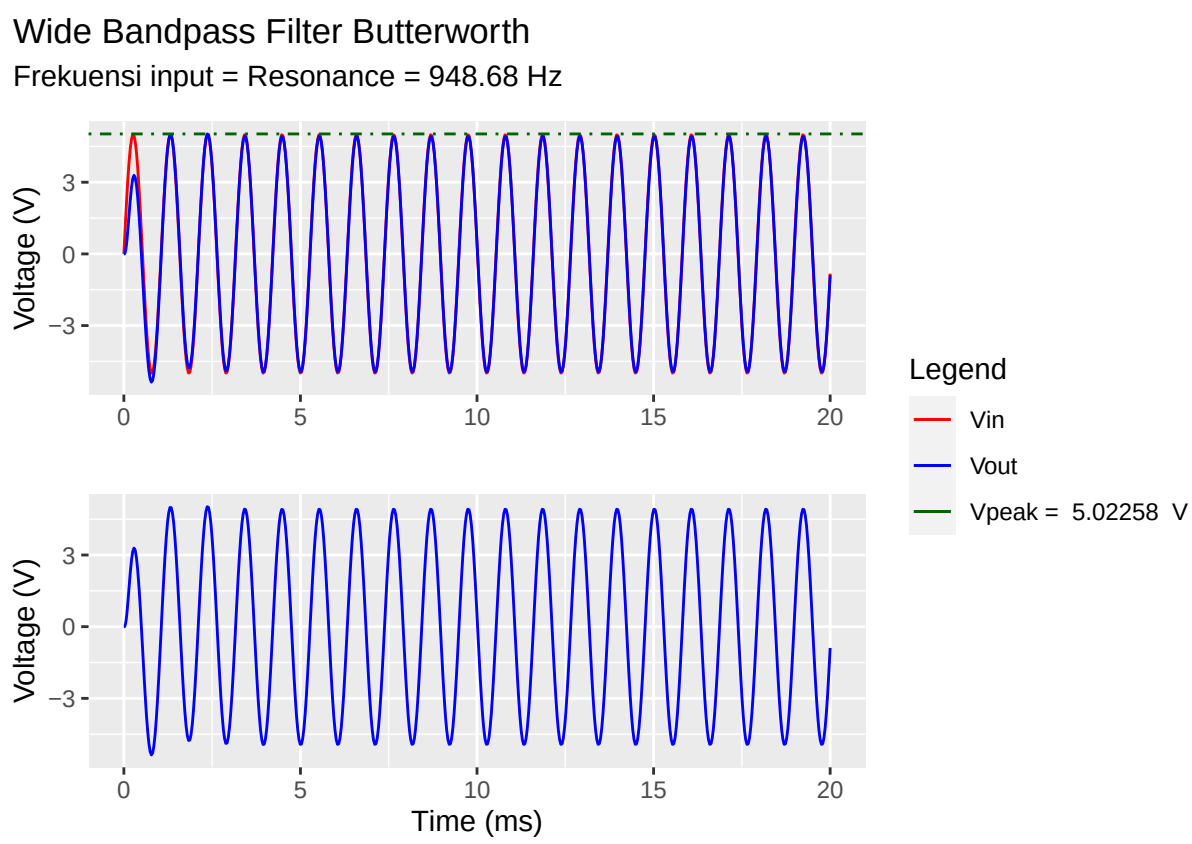
5.1.1 F = Cutoff Lower = 300 Hz

```
peak <- max(wide_bpf_fL$WideBPF)
ggplot(wide_bpf_fL) +
  geom_line(aes(x = TIME * 1000, y = Vin, color = "Vin")) +
  geom_line(aes(x = TIME * 1000, y = WideBPF, color = "Vout")) +
  geom_hline(aes(yintercept = peak, color = "Peak"), linetype = 4) +

  scale_color_manual(name = "Legend",
                     values = c("Vin" = "red", "Vout" = "blue",
                                "Peak" = "dark green"),
                     labels = c("Vin", "Vout", paste("Vpeak = ", peak, " V"))) +
  labs(title = "Wide Bandpass Filter Butterworth",
       subtitle = "Frekuensi input = lower cutoff = 300 Hz",
       x = "Time (ms)",
       y = "Voltage (V)")
```



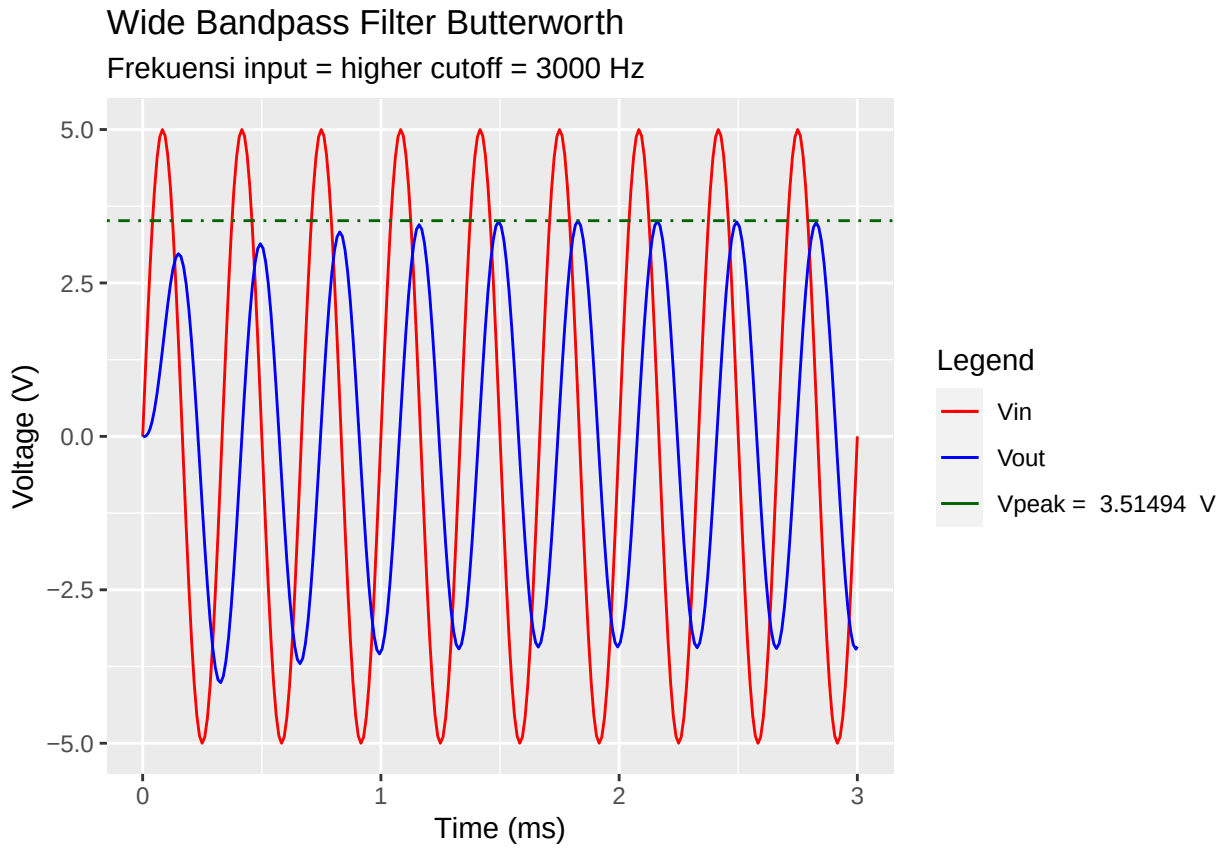
5.1.2 F = Resonance Frequency = 948.68 Hz

```
peak <- max(wide_bpf_fR$WideBPF)
p1 <- ggplot(wide_bpf_fR) +
  geom_line(aes(x = TIME * 1000, y = Vin, color = "Vin")) +
  geom_line(aes(x = TIME * 1000, y = WideBPF, color = "Vout")) +
  geom_hline(aes(yintercept = peak, color = "Peak"), linetype = 4) +

  scale_color_manual(name = "Legend",
                     values = c("Vin" = "red", "Vout" = "blue",
                                "Peak" = "dark green"),
                     labels = c("Vin", "Vout", paste("Vpeak = ", peak, " V"))) +
  xlab("")

p2 <- ggplot(wide_bpf_fR) +
  geom_line(aes(x = TIME * 1000, y = WideBPF), color = "blue") +
  xlab("Time (ms)")


p1 / p2 +
  plot_layout(guides = "collect") +
  plot_annotation(title = "Wide Bandpass Filter Butterworth",
                  subtitle = "Frekuensi input = Resonance = 948.68 Hz") &
  ylab("Voltage (V)")
```



5.1.3 F = Cutoff Higher = 3000 Hz

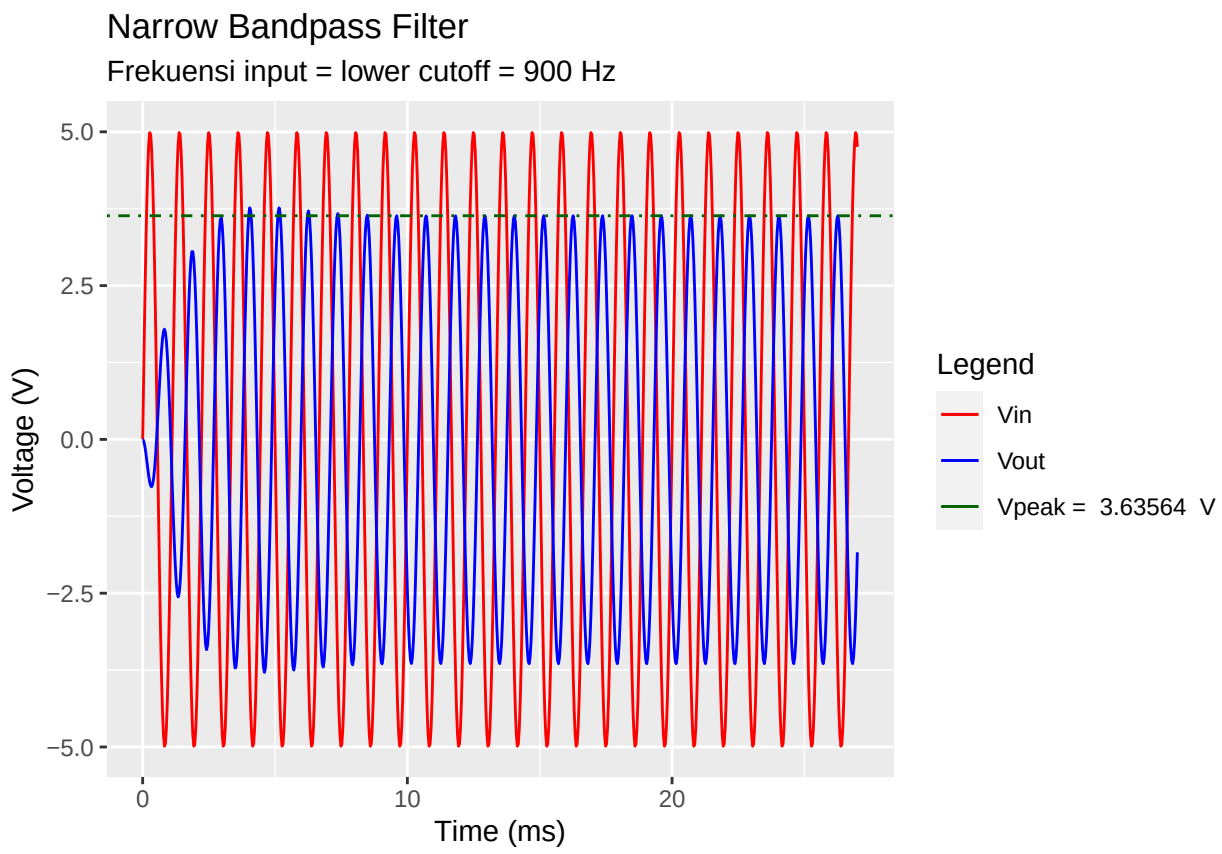
```
peak <- max(wide_bpf_fH$WideBPF)
ggplot(wide_bpf_fH) +
  geom_line(aes(x = TIME * 1000, y = Vin, color = "Vin")) +
  geom_line(aes(x = TIME * 1000, y = WideBPF, color = "Vout")) +
  geom_hline(aes(yintercept = peak, color = "Peak"), linetype = 4) +

  scale_color_manual(name = "Legend",
                     values = c("Vin" = "red", "Vout" = "blue",
                                "Peak" = "dark green"),
                     labels = c("Vin", "Vout", paste("Vpeak = ", peak, " V"))) +
  labs(title = "Wide Bandpass Filter Butterworth",
       subtitle = "Frekuensi input = higher cutoff = 3000 Hz",
       x = "Time (ms)",
       y = "Voltage (V)")
```



5.2 Narrow Bandpass Filter

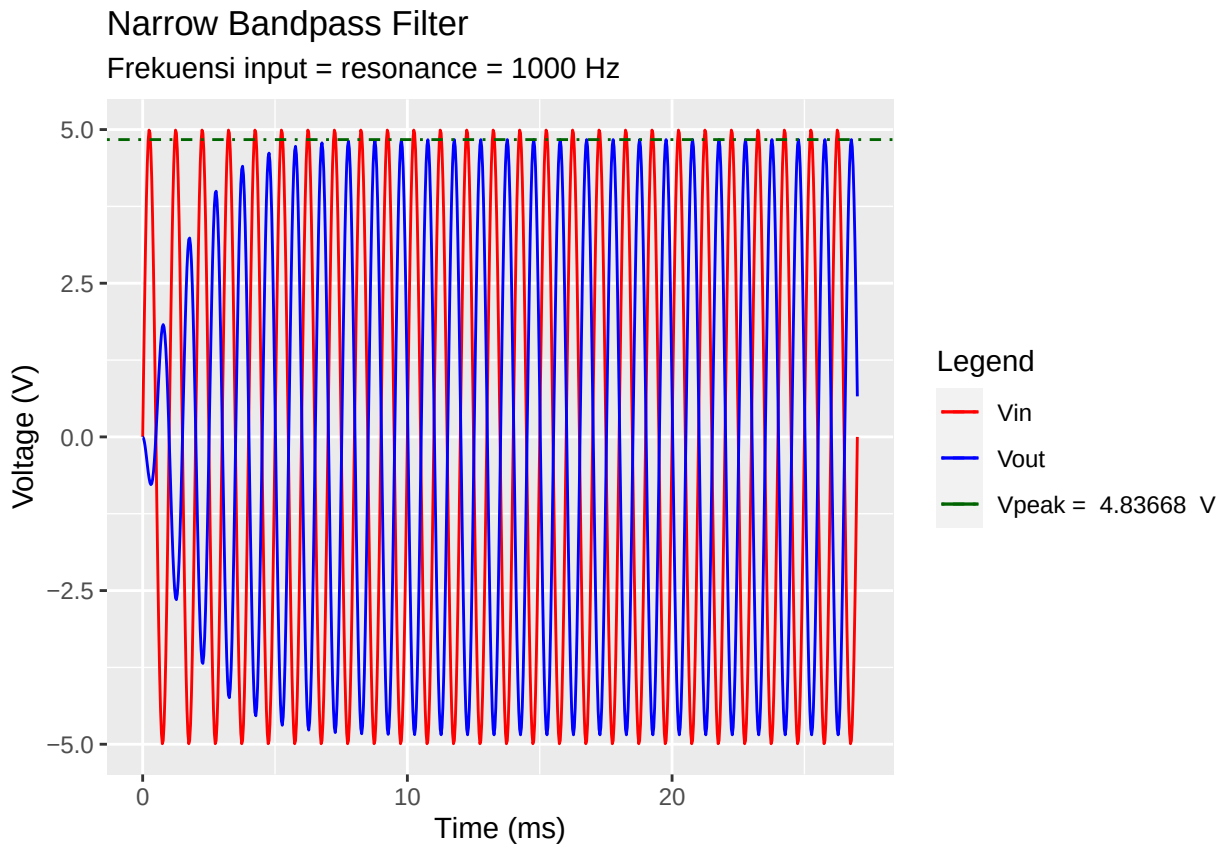
5.2.1 F = 900 Hz

```
peak <- notch_narrow_fL %>%
  dplyr::filter(TIME * 1000 > 10) %>%
  dplyr::select(NarrowBPF) %>%
  max()

ggplot(notch_narrow_fL) +
  geom_line(aes(x = TIME * 1000, y = Vin, color = "Vin")) +
  geom_line(aes(x = TIME * 1000, y = NarrowBPF, color = "Vout")) +
  geom_hline(aes(yintercept = peak, color = "Peak"), linetype = 4) +

  scale_color_manual(name = "Legend",
                     values = c("Vin" = "red", "Vout" = "blue",
                                "Peak" = "dark green"),
                     labels = c("Vin", "Vout", paste("Vpeak = ", peak, " V"))) +
  labs(title = "Narrow Bandpass Filter",
       subtitle = "Frekuensi input = lower cutoff = 900 Hz",
       x = "Time (ms)",
       y = "Voltage (V)")
```



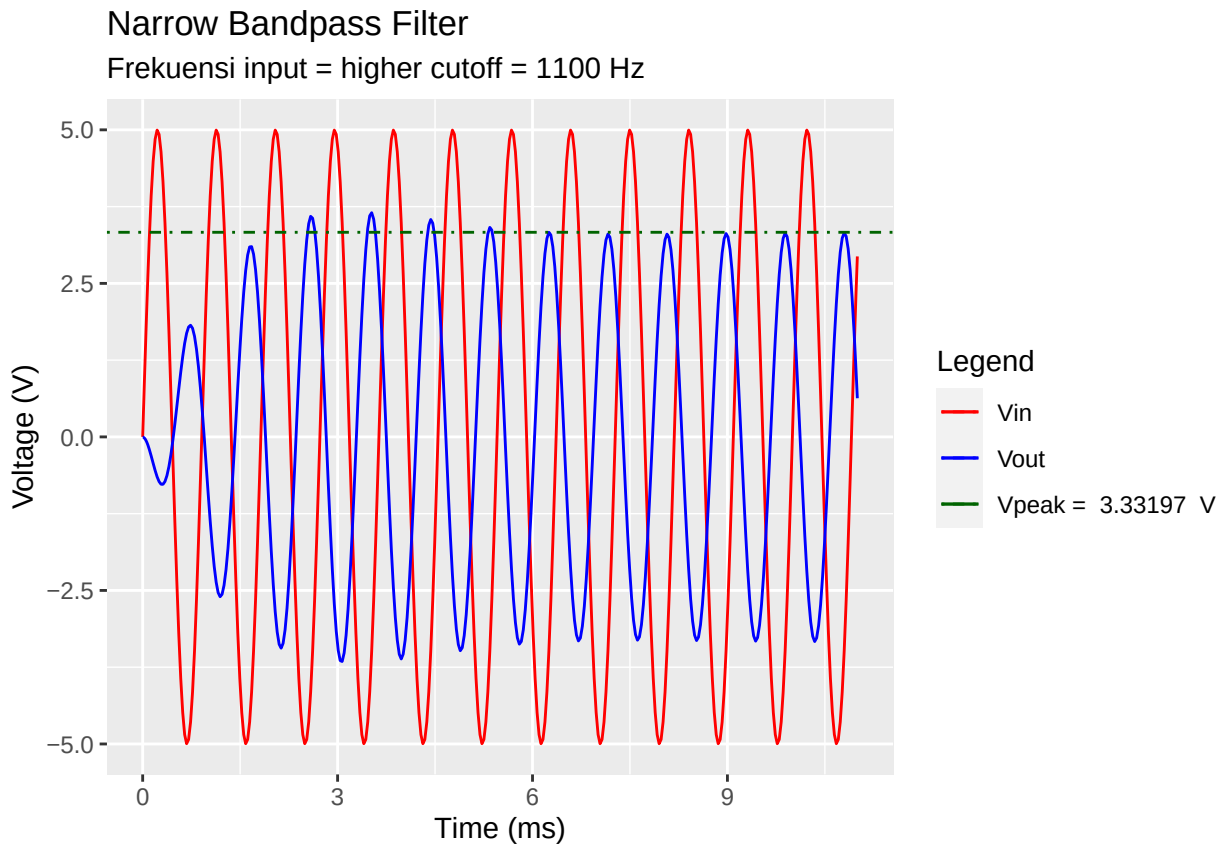
5.2.2 F = 1000 Hz

```
peak <- notch_narrow_fR %>%
  dplyr::filter(TIME * 1000 > 10) %>%
  dplyr::select(NarrowBPF) %>%
  max()

ggplot(notch_narrow_fR) +
  geom_line(aes(x = TIME * 1000, y = Vin, color = "Vin")) +
  geom_line(aes(x = TIME * 1000, y = NarrowBPF, color = "Vout")) +
  geom_hline(aes(yintercept = peak, color = "Peak"), linetype = 4) +

  scale_color_manual(name = "Legend",
                     values = c("Vin" = "red", "Vout" = "blue",
                                "Peak" = "dark green"),
                     labels = c("Vin", "Vout", paste("Vpeak = ", peak, " V"))) +
  labs(title = "Narrow Bandpass Filter",
       subtitle = "Frekuensi input = resonance = 1000 Hz",
       x = "Time (ms)",
       y = "Voltage (V)")
```



5.2.3 F = 1100 Hz

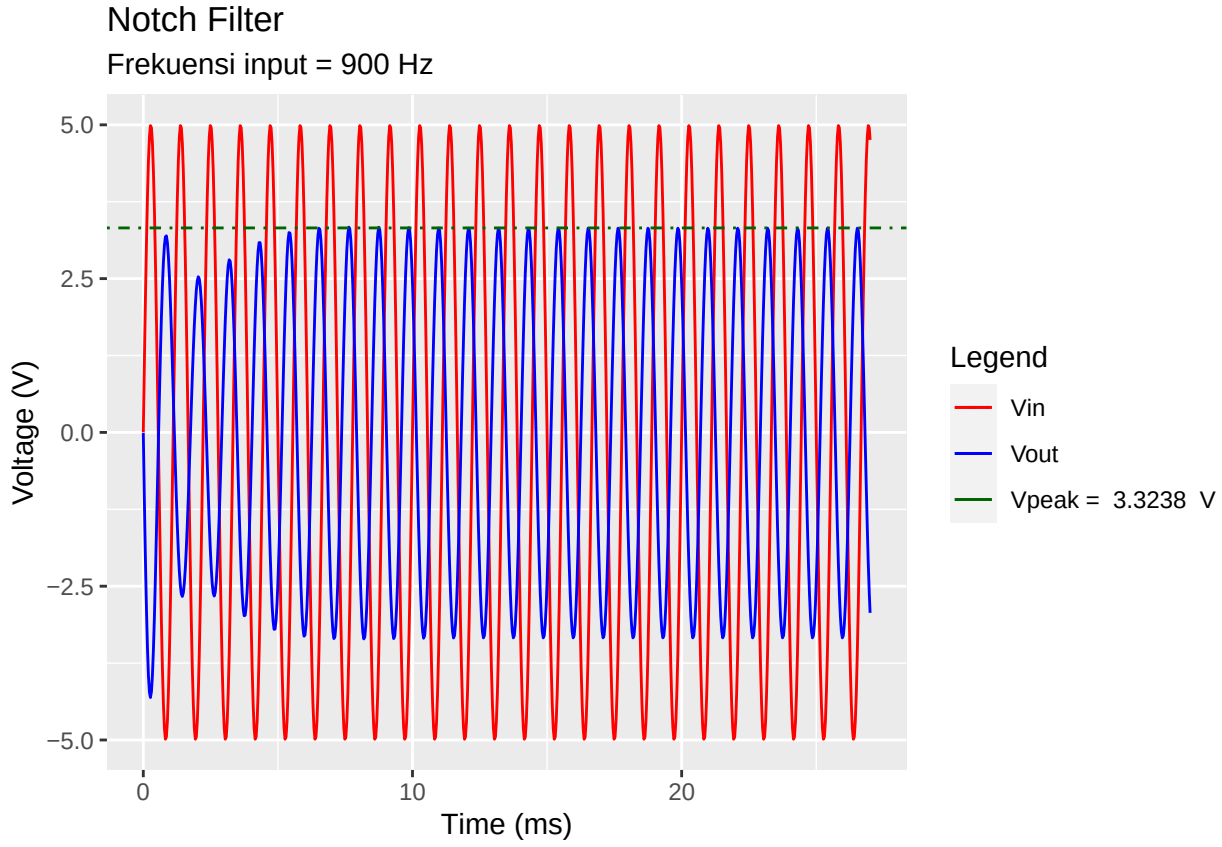
```
peak <- notch_narrow_fH %>%
  dplyr::filter(TIME * 1000 > 6) %>%
  dplyr::select(NarrowBPF) %>%
  max()

ggplot(notch_narrow_fH) +
  geom_line(aes(x = TIME * 1000, y = Vin, color = "Vin")) +
  geom_line(aes(x = TIME * 1000, y = NarrowBPF, color = "Vout")) +
  geom_hline(aes(yintercept = peak, color = "Peak"), linetype = 4) +

  scale_color_manual(name = "Legend",
                     values = c("Vin" = "red", "Vout" = "blue",
                                "Peak" = "dark green"),
                     labels = c("Vin", "Vout", paste("Vpeak = ", peak, " V"))) +
  labs(title = "Narrow Bandpass Filter",
       subtitle = "Frekuensi input = higher cutoff = 1100 Hz",
       x = "Time (ms)",
       y = "Voltage (V)")
```



5.3 Notch Filter

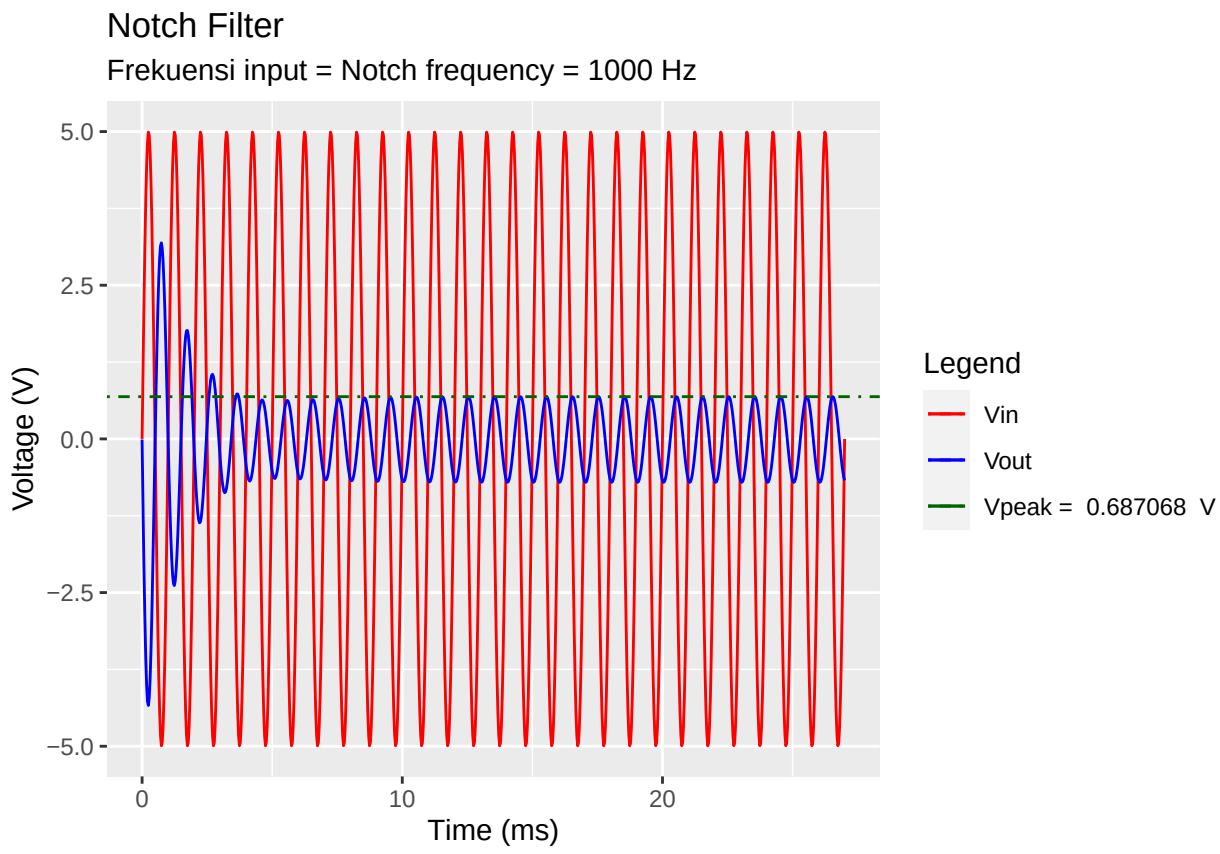
5.3.1 F = 900 Hz

```
peak <- notch_narrow_fL %>%
  dplyr::filter(TIME * 1000 > 10) %>%
  dplyr::select(Notch) %>%
  max()

ggplot(notch_narrow_fL) +
  geom_line(aes(x = TIME * 1000, y = Vin, color = "Vin")) +
  geom_line(aes(x = TIME * 1000, y = Notch, color = "Vout")) +
  geom_hline(aes(yintercept = peak, color = "Peak"), linetype = 4) +

  scale_color_manual(name = "Legend",
                     values = c("Vin" = "red", "Vout" = "blue",
                                "Peak" = "dark green"),
                     labels = c("Vin", "Vout", paste("Vpeak = ", peak, " V"))) +
  labs(title = "Notch Filter",
       subtitle = "Frekuensi input = 900 Hz",
       x = "Time (ms)",
       y = "Voltage (V)")
```



5.3.1 F = 1000 Hz

```
peak <- notch_narrow_fR %>%
  dplyr::filter(TIME * 1000 > 10) %>%
  dplyr::select(Notch) %>%
  max()

ggplot(notch_narrow_fR) +
  geom_line(aes(x = TIME * 1000, y = Vin, color = "Vin")) +
  geom_line(aes(x = TIME * 1000, y = Notch, color = "Vout")) +
  geom_hline(aes(yintercept = peak, color = "Peak"), linetype = 4) +

  scale_color_manual(name = "Legend",
                     values = c("Vin" = "red", "Vout" = "blue",
                                "Peak" = "dark green"),
                     labels = c("Vin", "Vout", paste("Vpeak = ", peak, " V"))) +
  labs(title = "Notch Filter",
       subtitle = "Frekuensi input = Notch frequency = 1000 Hz",
       x = "Time (ms)",
       y = "Voltage (V)")
```



5.3.1 F = 1100 Hz

```
peak <- notch_narrow_fH %>%
  dplyr::filter(TIME * 1000 > 6) %>%
  dplyr::select(Notch) %>%
  max()

ggplot(notch_narrow_fH) +
  geom_line(aes(x = TIME * 1000, y = Vin, color = "Vin")) +
  geom_line(aes(x = TIME * 1000, y = Notch, color = "Vout")) +
  geom_hline(aes(yintercept = peak, color = "Peak"), linetype = 4) +

  scale_color_manual(name = "Legend",
                     values = c("Vin" = "red", "Vout" = "blue",
                                "Peak" = "dark green"),
                     labels = c("Vin", "Vout", paste("Vpeak = ", peak, " V"))) +
  labs(title = "Notch Filter",
       subtitle = "Frekuensi input = 1100 Hz",
       x = "Time (ms)",
       y = "Voltage (V)")
```