

# Determining $g(F)$ for Gain 500

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## Analysis: Step 1: $g(f)$

Make sure that the data is in the same folder as the R-script (should be automatic if you clone the git repo)  
(btw I hate myself for saying “clone the git repo”)

Plots to verify what the data looks like.

```
vin1<-read.csv("V1.CSV")
names(vin1)<-c("x", "y")
vin2<-read.csv("V2.CSV")
names(vin2)<-c("x", "y")
vin3<-read.csv("V3.CSV")
names(vin3)<-c("x", "y")
vin4<-read.csv("V4.CSV")
names(vin4)<-c("x", "y")
vin5<-read.csv("V5.CSV")
names(vin5)<-c("x", "y")
vout1<-read.csv("01.CSV")
names(vout1)<-c("x", "y")
vout2<-read.csv("02.CSV")
names(vout2)<-c("x", "y")
vout3<-read.csv("03.CSV")
names(vout3)<-c("x", "y")
vout4<-read.csv("04.CSV")
names(vout4)<-c("x", "y")
vout5<-read.csv("05.CSV")
names(vout5)<-c("x", "y")
```

Find the mean of each value: It should be noted that the vin voltages are flat whereas the vout voltages are peaked, so dont just take average

```
m_in<- (vin1$y+vin2$y+vin3$y+vin4$y+vin5$y)/5
#take average of vouts
m_vout <- data.frame(Frequency = vout1$x, Volts = (vout1$y+vout2$y+vout3$y+vout4$y+vout5$y)/5)
```

Now we have the mean in and the mean out so we can find the gain:

```
#compute gain using the average vouts and m_in
gain <- data.frame(Frequency = vout1$x, Gain = (m_vout[2]/m_in))

#this is consistent with the max gain of 150 calculated in class.
```

## Calculating Error

not really sure how to calculate error of a function. going to take RMSE for each.

```
rmserrors <- sqrt(data.frame(
  vin1 = sum(((m_in-vin1$y)^2))/399,
```

```

vin2 = sum((m_in-vin2$y)^2)/399,
vin3 = sum((m_in-vin3$y)^2)/399,
vin4 = sum((m_in-vin4$y)^2)/399,
vin5 = sum((m_in-vin5$y)^2)/399,
vout1 = sum((m_vout$Volts-vout1$y)^2)/399,
vout2 = sum((m_vout$Volts-vout2$y)^2)/399,
vout3 = sum((m_vout$Volts-vout3$y)^2)/399,
vout4 = sum((m_vout$Volts-vout4$y)^2)/399,
vout5 = sum((m_vout$Volts-vout5$y)^2)/399
))
#error in gain, adding in quadrature:
vinerror <-sqrt(sum(rmserrors[1:5]^2))
voutererror <- sqrt(sum(rmserrors[6:10]^2))
gainerror <- gain[2]*sqrt((vinerror/m_in)^2+(voutererror*(m_vout[2])^-1)^2)
#g(f) error

```

## Plot g(f)

```

library(ggplot2)
#qplot(unlist(gain$Frequency[24:80]),unlist(gain$Volts[24:80]))+geom_errorbar(aes(x=unlist(gain$Frequency[24:80]),y=unlist(gain$Volts[24:80]),ymin=unlist(gain$Volts[24:80])-gainerror,ymax=unlist(gain$Volts[24:80])+gainerror))
qplot(unlist(gain$Frequency[11:41]),unlist(gain$Volts[11:41]))+geom_errorbar(aes(x=unlist(gain$Frequency[11:41]),y=unlist(gain$Volts[11:41]),ymin=unlist(gain$Volts[11:41])-gainerror,ymax=unlist(gain$Volts[11:41])+gainerror))

```

The Gain Function g(F)

