

## HW6\_Plot-TimeSeriesAnalysis

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# plot help sources:
# https://stats.idre.ucla.edu/r/codefragments/greek\_letters/
# https://www.datacamp.com/community/tutorials/15-questions-about-r-plots#q3
# http://onertipaday.blogspot.com/2008/09/fitting-text-under-plot.html
# -----
# For a more detailed explanation for the power spectrum plot
# refer to the end of HW6-TimeSeries

# The power spectrum of MA(2):

# At omega = 0:
#  $(1+\theta_1+\theta_2)^2$ 

# At omega =  $\pi/2$ ,
#  $1 - (2*\theta_2) + (\theta_1^2) + (\theta_2^2)$ 

# At omega =  $\pi$ 
#  $(1-\theta_1+\theta_2)^2$ 
# -----

# Create a dataframe with omega values (0 to pi) in it
mainDf <- data.frame(omegaVal = seq(0, pi, by = 0.01))
# we set theta1 and theta2 values for plotting
theta1 <- 0.75 # set theta1 to be 0.5
theta2 <- 0.1 #set theta2 to be 0.1

# Create the value of the power spectrum
# for the given data
for(i in 1:length(mainDf$omegaVal)){
  mainDf$yVal[i] <- 1 + (theta1^2) + (theta2^2) +
    (2*(theta1+(theta1*theta2))*cos(mainDf$omegaVal[i])) +
    (2*(theta2)*cos(2*mainDf$omegaVal[i]))
}

# plot a cosine wave for current power spectrum of MA(2) data
x <- mainDf$omegaVal
y <- mainDf$yVal

# Define the position of x-axis tick marks
v1 <- c(0,pi/2,pi)
# Define the labels of x-axis tick marks
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v2 <- c("0","pi/2","pi")

# Define the position of y-axis tick marks
h1 <-c(1 + (theta1^2) + (theta2^2) +
      (2*(theta1+(theta1*theta2))*cos(0)) +
      (2*(theta2)*cos(2*0)),
      1 + (theta1^2) + (theta2^2) +
      (2*(theta1+(theta1*theta2))*cos(pi/2)) +
      (2*(theta2)*cos(2*pi/2)),
      1 + (theta1^2) + (theta2^2) +
      (2*(theta1+(theta1*theta2))*cos(pi)) +
      (2*(theta2)*cos(2*pi)))

# Define the labels of y-axis tick marks
h2 <- c("(1+theta1+theta2)^2","1 - (2*theta2) + (theta1^2) + (theta2^2)","(1-
theta1+theta2)^2")

# 'mar' A numerical vector of the form 'c(bottom, left, top, right)'
# which gives the number of lines of margin to be specified on
# the four sides of the plot. The default is 'c(5, 4, 4, 2) + 0.1'.
op <- par(mar=c(5,15,4,0.5)+0.1)

plot(x,y,type="l",col= colors()[100], main=expression(paste("2", pi, "/",
sigma^2, ' S'[y], '(' ,omega, ") Graph")), xlab=expression(omega), ylab="
",xaxt = "n",yaxt = "n")

axis(side = 1, at = v1, labels = v2, tck=-.05) # x-axis
axis(side = 2, at = h1, labels = h2, tck=-.05, las=1) # y-axis
abline(h=h1, v=v1, lty=5, col="lightgrey") # grid Lines

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