Kalman filter: A linear Gaussian state-space model represents the latent state evolution and observations. The Kalman filter recursively computes the optimal (minimum variance) state estimate by alternating prediction and update steps weighted by the Kalman gain. Tuning process/observation noise controls smoothness versus responsiveness.

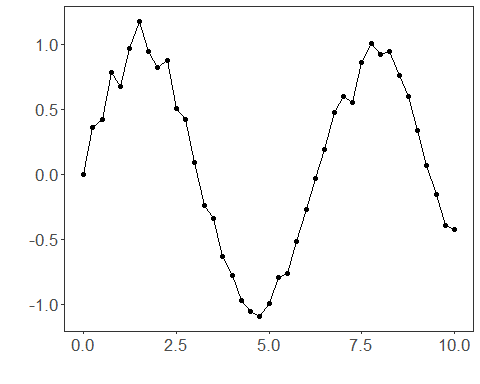
Objective: Smooth the series using a state-space model with a Kalman Filter, controlling observation noise (H) and process noise (Q).

# Filter - Kalman  
  
# Installing the package (if needed)  
#install.packages("tspredit")

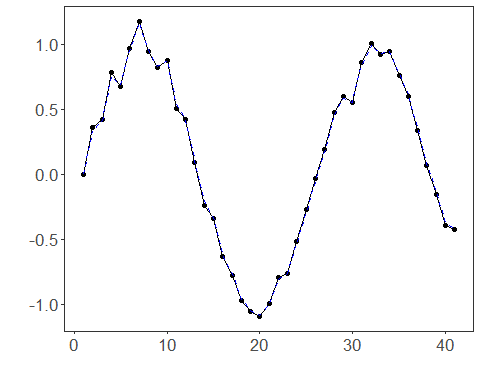
# Loading the packages  
library(daltoolbox)  
library(tspredit)

# Series for study with artificial noise and spikes  
  
data(tsd)  
y <- tsd$y  
noise <- rnorm(length(y), 0, sd(y)/10)  
spike <- rnorm(1, 0, sd(y))  
tsd$y <- tsd$y + noise  
tsd$y[10] <- tsd$y[10] + spike  
tsd$y[20] <- tsd$y[20] + spike  
tsd$y[30] <- tsd$y[30] + spike

library(ggplot2)  
# Noisy series visualization  
plot\_ts(x=tsd$x, y=tsd$y) + theme(text = element\_text(size=16))



# Applying the Kalman filter  
  
filter <- ts\_fil\_kalman(H = 0.1, Q = 1)  
filter <- fit(filter, tsd$y)  
y <- transform(filter, tsd$y)  
plot\_ts\_pred(y=tsd$y, yadj=y) + theme(text = element\_text(size=16))



References - R. E. Kalman (1960). A New Approach to Linear Filtering and Prediction Problems. Journal of Basic Engineering, 82(1), 35–45.