QES Filter: QES extends exponential smoothing by incorporating higher‑order trend components through recursively updated equations. It generalizes single and double exponential smoothing (Holt/Brown) with additional curvature terms to better track accelerating or decelerating trends. Key parameter - gamma: controls whether seasonal/trend gain is adapted (package-specific); set to FALSE to keep default behavior.

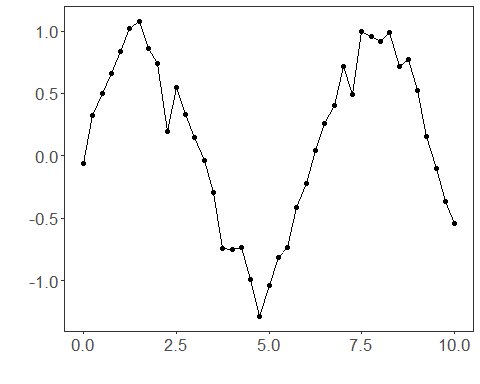
Objectives: Quadratic Exponential Smoothing (QES) models level and trend using exponentially weighted averages with a quadratic form. It is useful for trend-dominated series where you want a smooth estimate that adapts to gradual changes.

# Filter - Quadratic Exponential Smoothing  
  
# Install tspredit if needed  
#install.packages("tspredit")

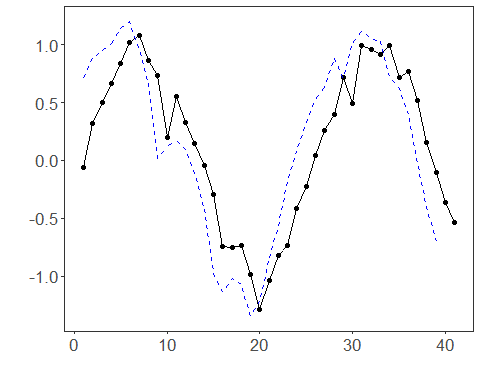
# Load packages  
library(daltoolbox)  
library(tspredit)

# Prepare a noisy series with injected 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)  
# Visualize the noisy input  
plot\_ts(x=tsd$x, y=tsd$y) + theme(text = element\_text(size=16))



# Apply Quadratic Exponential Smoothing  
  
filter <- ts\_fil\_qes(gamma = FALSE) # default behavior without gamma adaptation  
filter <- fit(filter, tsd$y)  
y <- transform(filter, tsd$y)  
  
# Compare original vs smoothed  
plot\_ts\_pred(y=tsd$y, yadj=y) + theme(text = element\_text(size=16))



References - E. S. Gardner Jr. (1985). Exponential smoothing: The state of the art. Journal of Forecasting, 4(1), 1–28. - E. S. Gardner Jr. (2006). Exponential smoothing: The state of the art—Part II. International Journal of Forecasting, 22(4), 637–666.