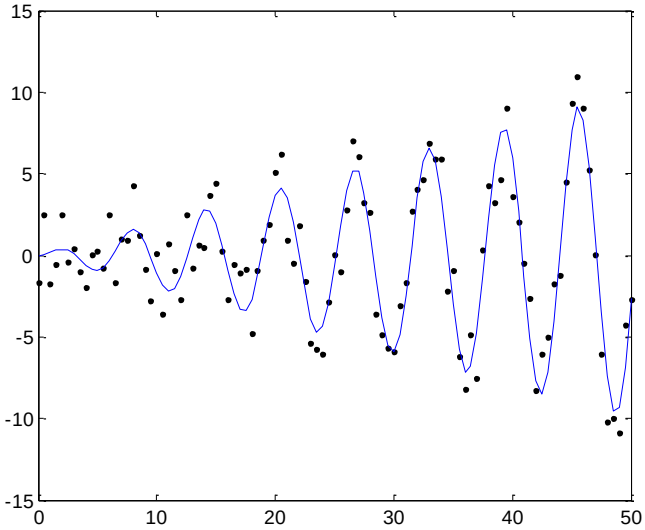
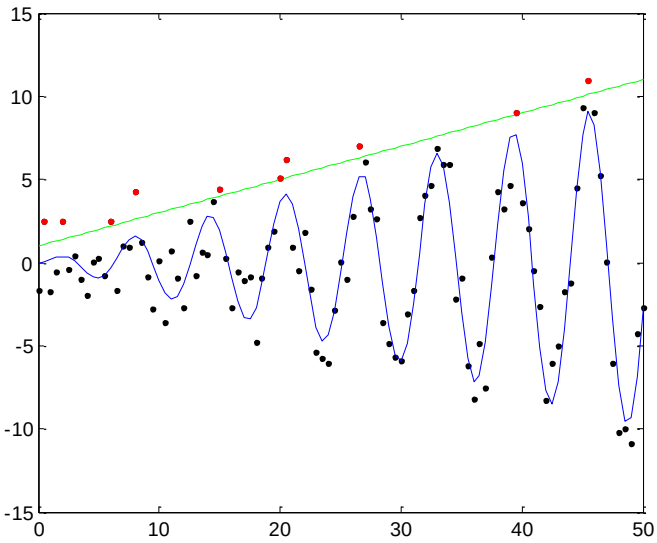
1) data analysis

a) read measured data from the file „hw03_data.txt“.

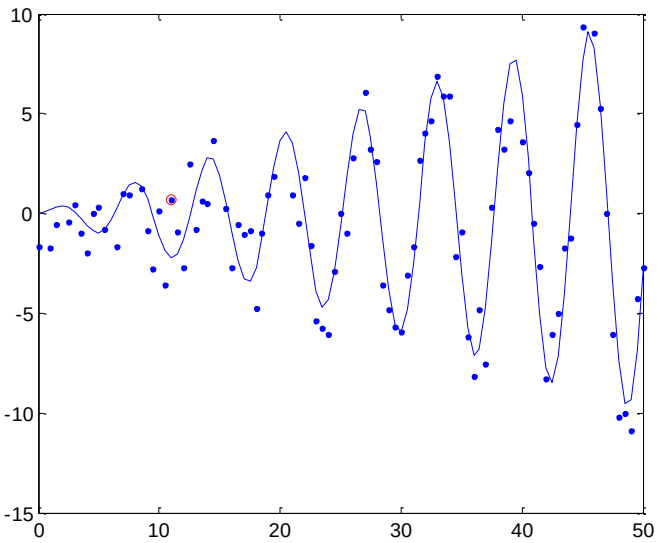
b) Plot this data and compare with the analytic function
$y_0(t) = \sin(t) \cdot t / 5$



c) Draw the line $y_1(t) = 1 + t / 5$ and mark all measured data above this line in red.



d) Delete all points above the line $y_1(t)$ from the data set and mark the data point that deviates maximally from the curve $y_0(t)$ by a red circle.



Homework 3 (sim07_loops/sim08_functions)

2) Twin prime

https://en.wikipedia.org/wiki/Twin_prime

Find all n prime twins with four digits (1000-9999) with *isprime()*

and write them all in a (n x 2)-matrix.

Can you do this without using a loop?

1019	1021
1031	1033
1049	1051
1061	1063
1091	1093
1151	1153

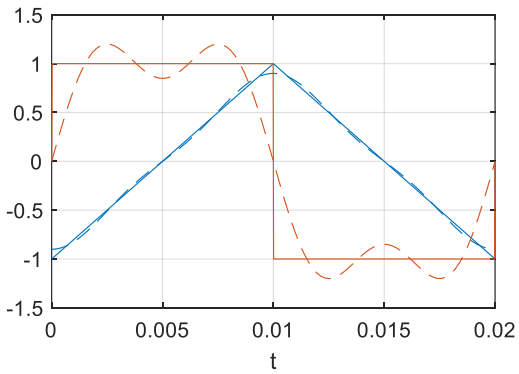
...

3) Fourier synthesis

$$f(t) = a_0 + \sum_{n=1}^{\infty} a_n \cos(\omega_n t) + b_n \sin(\omega_n t)$$

a) create the function `[t,y] = fsynthesis(a0,fn,an,bn)` that calculates and plots the fourier approximation from the given coefficients.

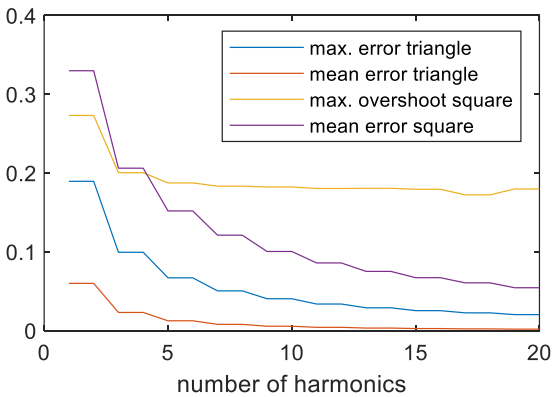
```
a0:  offset (DC value)
fn:  vector of harmonic frequencies
an:  vector of cos-amplitudes
bn:  vector of sin-amplitudes
```



http://de.wikipedia.org/wiki/Fourierreihe#Beispiele

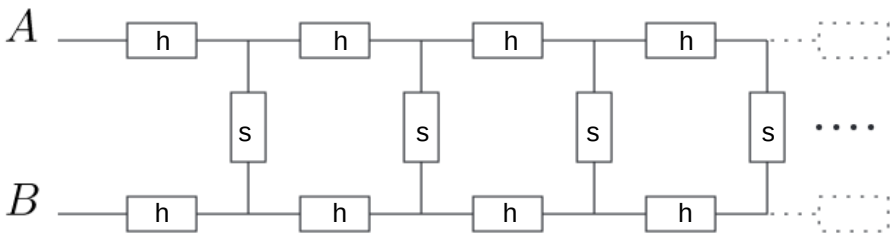
b) Plot a triangle and square signal with frequency f=50Hz together with the fourier approximation up to the third harmonic.

c) Plot the maximum and average deviation between original and Fourier approximation as a function of the number of harmonics.
For the rectangular function, the height of the overshoot is plotted instead of the maximum deviation.This error does not decrease with increasing number of harmonics = Gibbs phenomenon !



4) resistance ladder

A resistor network is composed of resistors h=2Ω und s=3Ω. Calculate the total resistance R_{AB} for an arbitrary length of the ladder.



Hint: You can use the function for a parallel circuit resistance from *sim08*
and/or use the cascade connection of elementary two-port networks (→ SUS)