Assignment III

Exercise 1 *Write a* MATLAB*-function which fits a linear combination of exponential functions to data.*

The input consists of the data, an $(m \times 2)$ matrix, and a vector of initial guesses for the exponents. The data are fit with a function of the form

$$f(x) = C_1 e^{\lambda_1 x} + C_2 e^{\lambda_2 x} + \ldots + C_n e^{\lambda_n x}.$$

The number of exponents n follows from the length of vector of the initial guesses given as input to the function. The function looks for the exponents and constants such that f is the best fit of the data in the sense of least squares. The output are two vectors (one with the calculated optimal exponents λ_i and one with the calculated optimal constants C_i) as well as the residue. Moreover, the function produces a picture of the data and the fit f.
N.B.: you are *not* supposed to use the optimisation function `lsqnonlin` even if it is available on your computer. On the other hand, you can use `fminsearch`.

1. For fixed $\lambda = (\lambda_1, \ldots, \lambda_n)$ you should use the least square method to find the best coefficients $C_i = C_i(\lambda)$ and calculate the corresponding residue $R = R(\lambda)$.
2. Using `fminsearch` you can subsequently minimize $R(\lambda)$.
3. You can, among others, test you function on the data in the file `expo-examples.mat` on the website. After downloading, `load expo-examples` gives you three data sets `data1`, `data2` and `data3`.
4. Estimate the values of the exponents which are "hidden" in these signals (you also still have to determine *how many* exponents are present).