Testing the methods

We will now test the methods, that we have described in the previous section. Due to computational limitations, we will test our methods on a simple model problem, namely locating the minimum of a 1d-function f defined on a closed interval I.

1.0.1 *Setup*

The methods we will test are the following. The LCB-method with values of $\kappa = 2, 4$, the EI-method with values of $\delta = 0, 1$ aswell as the pure-exploitation method. As our test function, we use a sum of random sine-function,

$$f_{test} = \sum_{i}^{n} a_i \sin(b_i x + c_i), \quad a_i, b_i, c_i \sim \mathcal{U}(0, 1)..$$

A random interval is then chosen and a few points $X = \{x_1, \ldots, x_n\}$ are sampled from said interval. These points are then evaluated in the random function f giving,

$$\text{Data} = (X, Y) = (X, f(X)).$$

The GPR-model G, is then fitted to this data, By brute force, the minimum of the function x_{min} is recorded for comparison. A threshold, ϵ, is chosen aswell, which represents the neighborhood around x_{min}, which we shall count as succesful. In other words, our search is succesful, if it samples a point x^+ satisfying,

$$\left| x_{min} - x^+ \right| < \epsilon.$$

For each method, all of these initial conditions are held constant. The GPR-model is then fitted to the sampled points, and the search is ready to commense.

1.0.2 *Search*

The search is conducted in the following way. For a fixed number of iterations, the search method S being tested probes the GPR-model and returns a point x^+ it recommends for sampling. This point is then compared to x_{min} and if it lies within a distance of ϵ, the search terminates. If not, $(x^+, f(x^+)$ is added to the data, and the GPR-model is updated. This process repeats until the minimum is found, or the number of iterations exceeds the limit. When the process finishes, the current iteration number is stored. This experiment is then repeated a number of times for each search method, the results are plotted *succes-curve*