

# Mathematical informatics

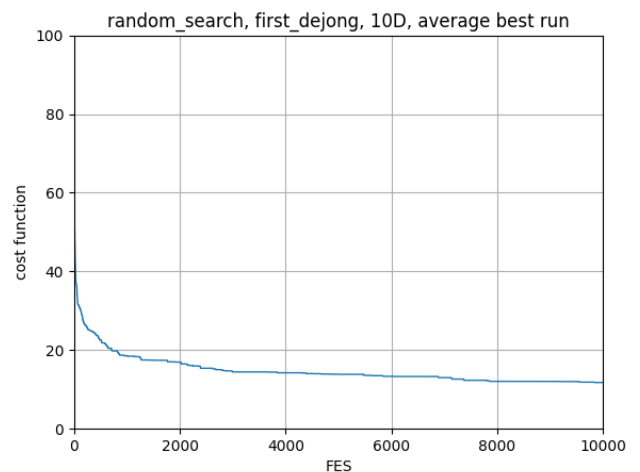
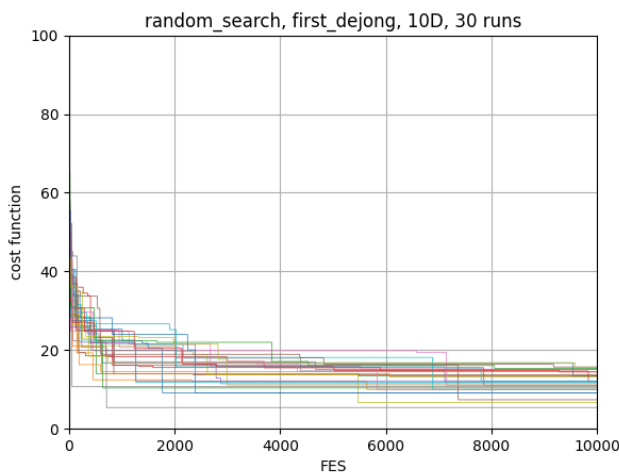
# Assignment

Benchmark of Local search, Random search and Simulated annealing algorithms with 1st DeJong, 2nd DeJong and Schwefel functions.

## Random search

Starts from a randomly chosen position and then until some criteria (eg. number of iterations performed) tries another random position (solution) within a given surrounding.

### 1st DeJong



min = 5.593590213981131

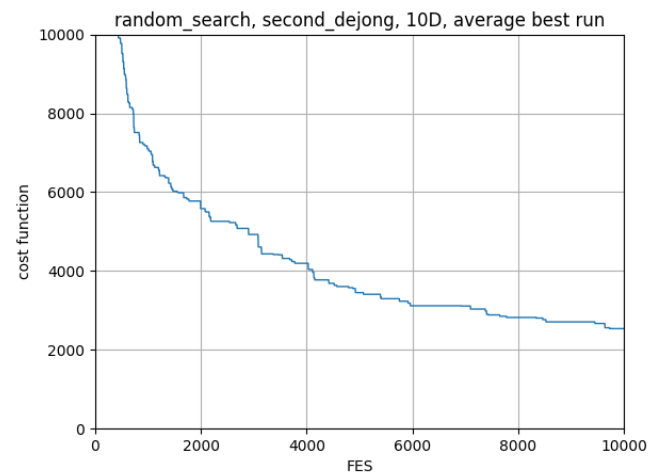
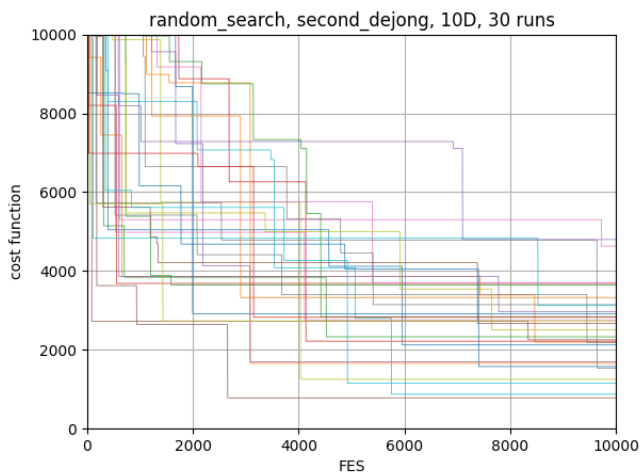
max = 18.097367491869893

mean = 11.976866164566825

median = 12.231670805557226

standard deviation = 2.6619891817449584

## 2nd DeJong



min = 1078.736308424624

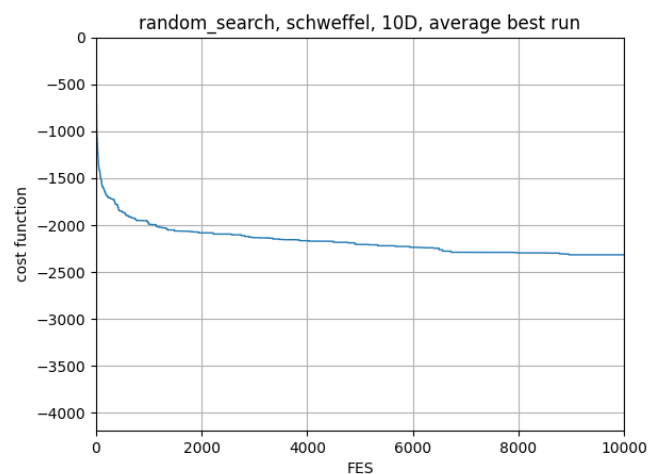
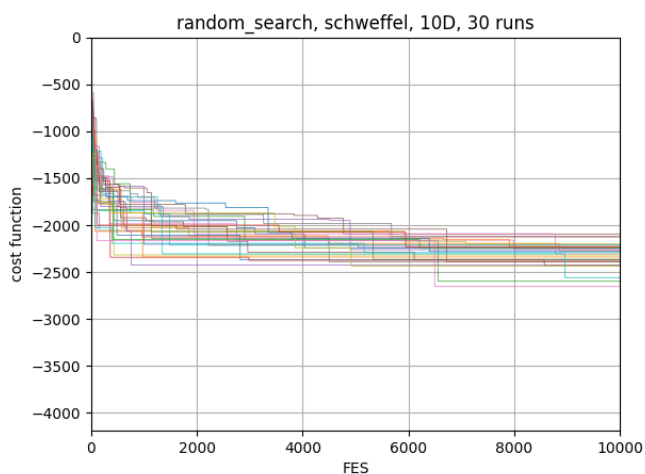
max = 4801.331026865194

mean = 2738.5267393062754

median = 2800.759267849512

standard deviation = 1026.8241254579727

## Schwefel



min = -2769.479549800826

max = -2065.4463689348822

mean = -2295.9487158331485

median = -2263.7598598636923

standard deviation = 169.39889027375946

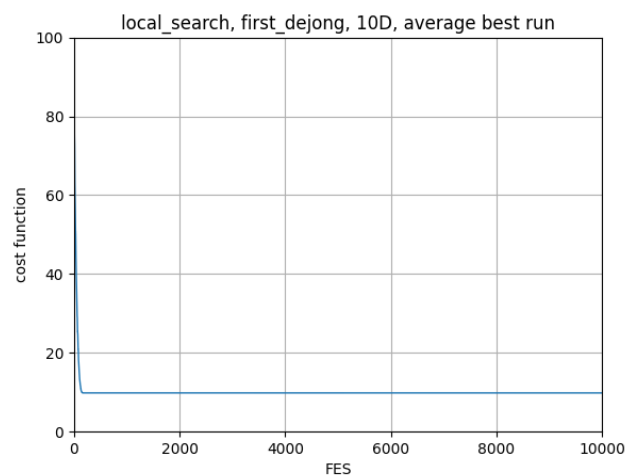
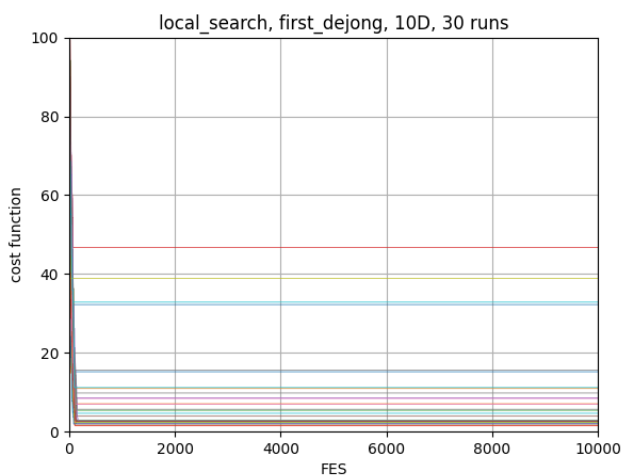
## Local search

neighborhood size = 10

local size percentage = 0.1

Starts from a randomly chosen position and then iteratively moves from one to another neighbor position (solution) within the given bounds.

### 1st DeJong



min = 1.2603861579934814

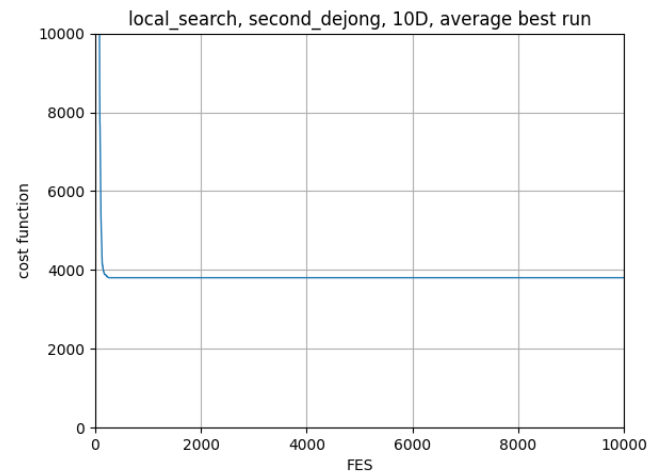
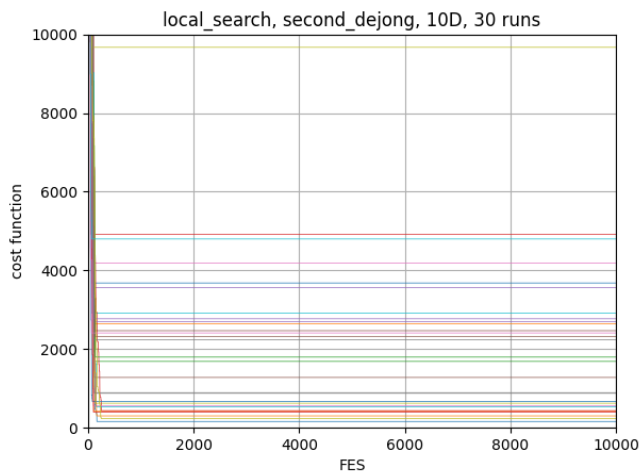
max = 44.3334887667238

mean = 9.244430176378952

median = 4.355929184461102

standard deviation = 11.679096119609053

## 2nd DeJong



min = 207.623314847859

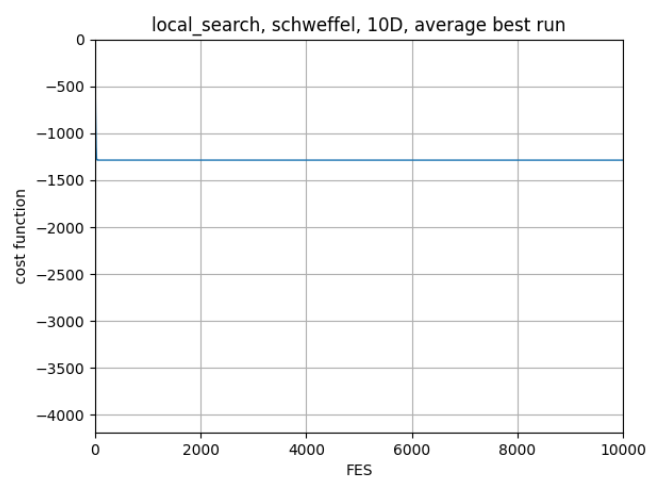
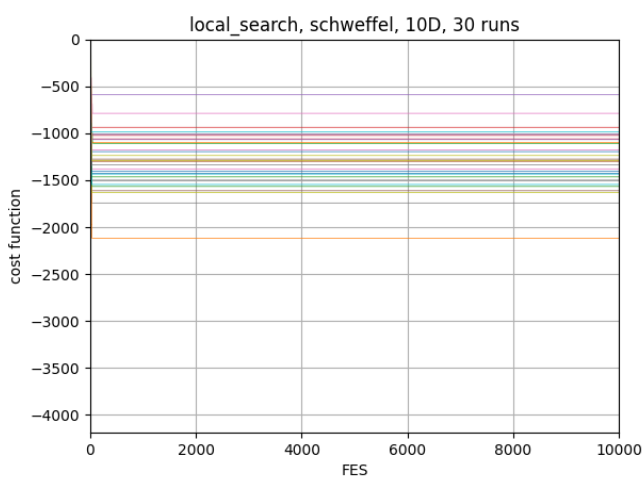
max = 26018.602762493963

mean = 6677.44401544489

median = 2371.1406374656635

standard deviation = 8399.870233454812

## Schwefel



min = -2208.481817501992

max = -236.8687968967047

mean = -1246.0249645250353

median = -1343.274412520807

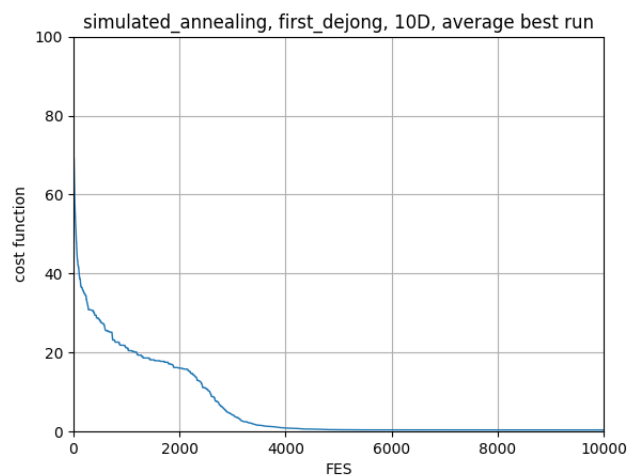
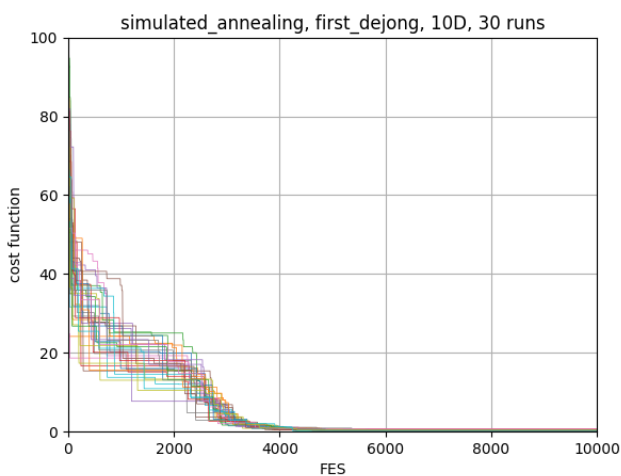
standard deviation = 451.35479100217253

## Simulated annealing

neighborhood size = 10  
 local size percentage = 0.1  
 cooling decrease = 0.98  
 MAX temperature = 1000  
 MIN temperature = 0.01

Mimics the physical annealing process of a metal.

### 1st DeJong



min = 0.22643026056788945

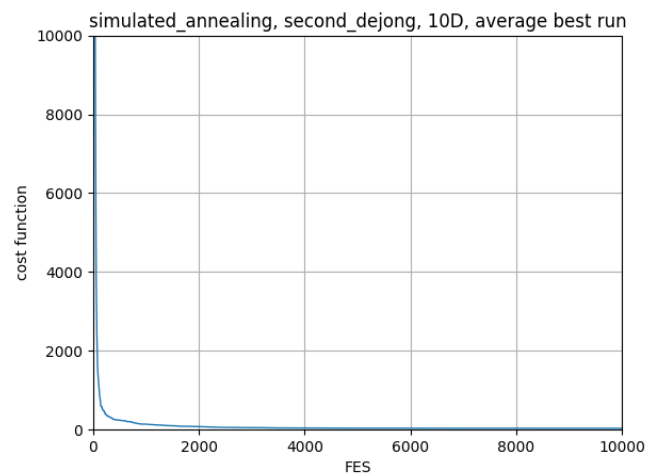
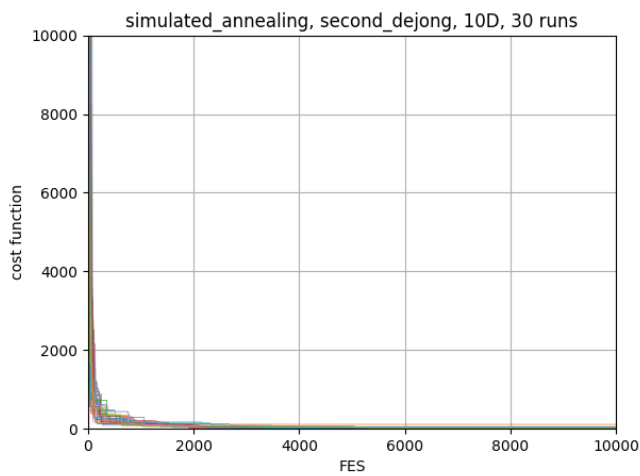
max = 0.6182069602158213

mean = 0.42129111527380103

median = 0.4195076535726737

standard deviation = 0.11204902739684064

## 2nd DeJong



min = 22.818956481360065

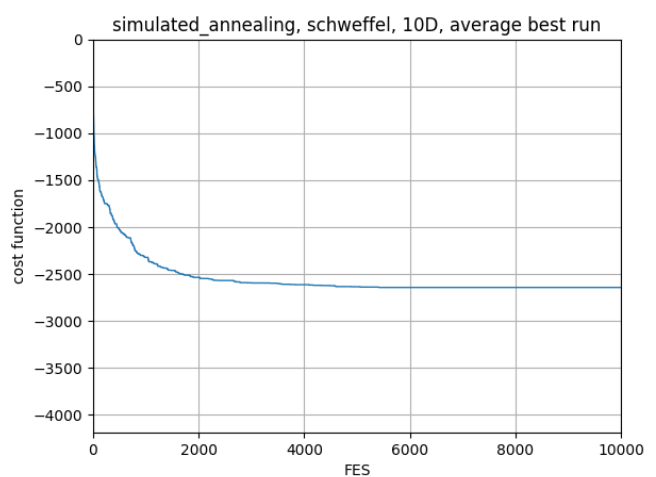
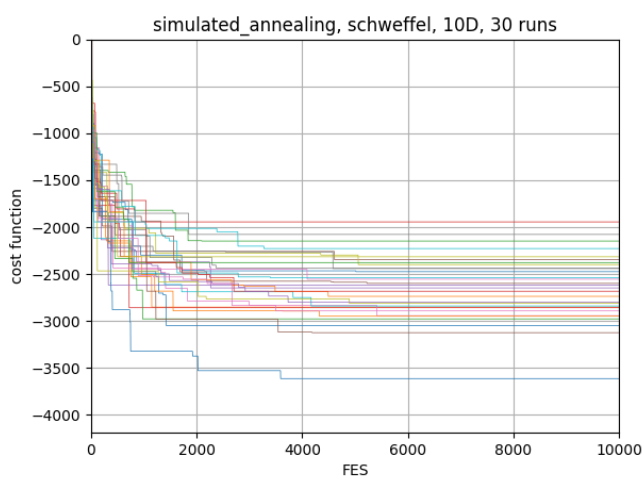
max = 124.93155958646132

mean = 39.42947025598873

median = 33.30880058924126

standard deviation = 20.426243058050286

## Schweffel



min = -3609.2679085604327

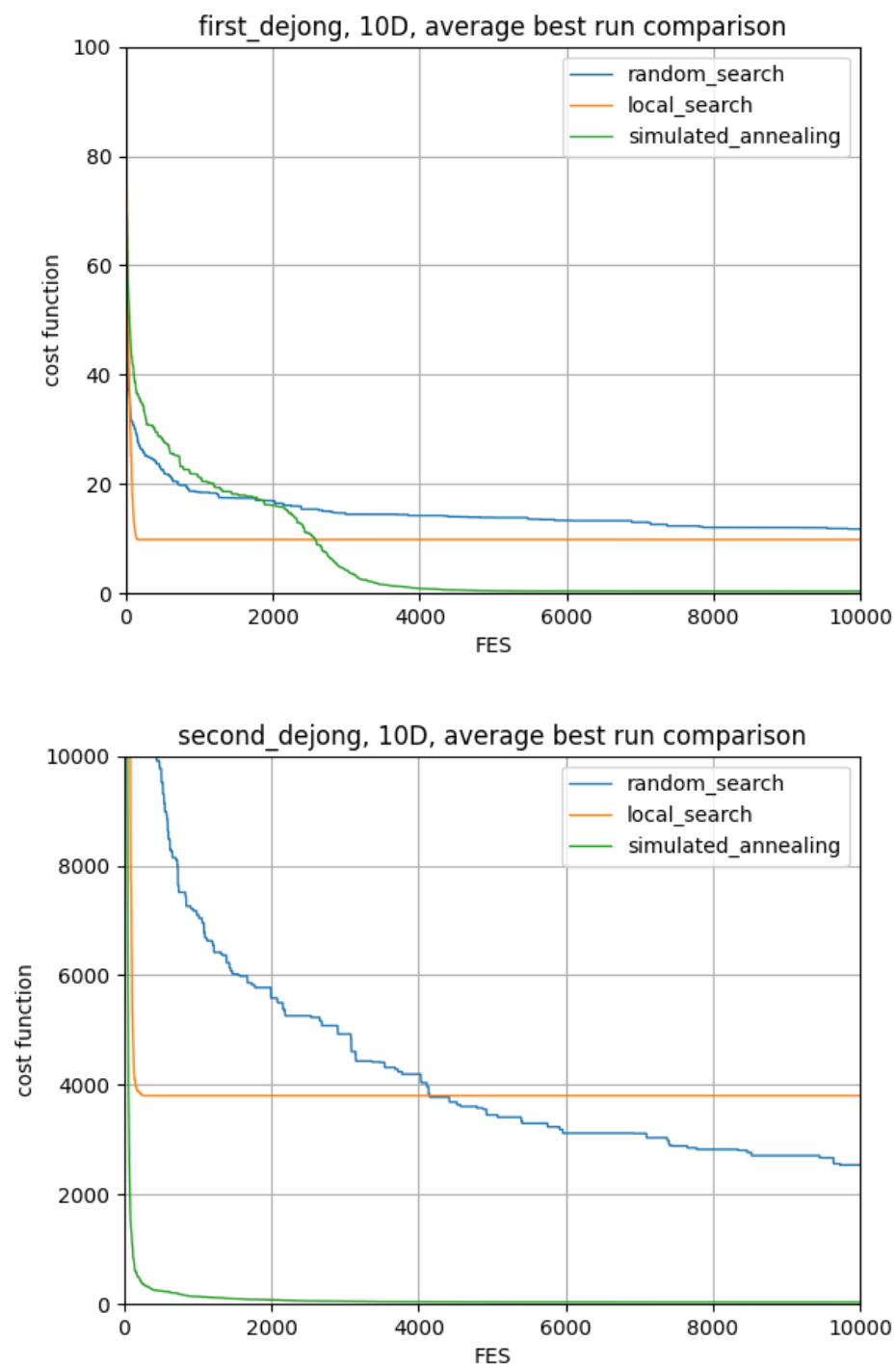
max = -2121.8323281153953

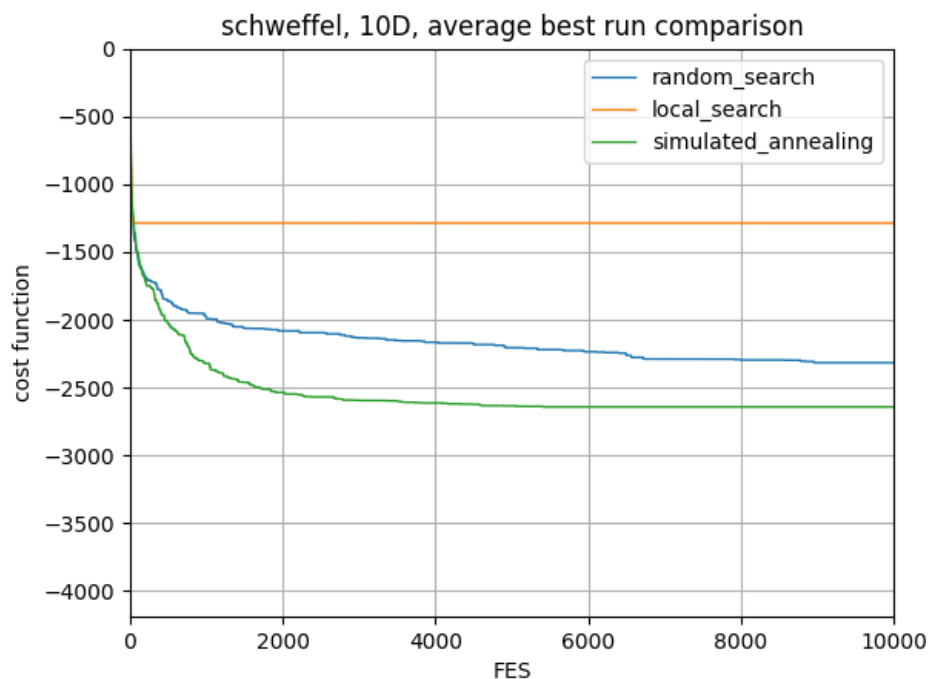
mean = -2649.747981146476

median = -2616.150845236727

standard deviation = 362.13204840484565

## Comparison





## Methodology

Run 30 times for each algorithm and cost function with the dimension set to 30 and FES to 10 000. If the algorithm finds the solution sooner, I still let it run until it reaches FES of 10 000 or stop it even if the algorithm haven't found the solution yet. We can see that the Random search slowly but successfully always finds the acceptable solution in the end, but Local search often gets stuck in the local minimum and isn't able to find global minimum. Simulated annealing is of course the most powerful among these.