# Evolutionary Algorithms 2017

# Practical Assignment II

## Solving the design of Optical Multilayer System Using Evolution Strategy

### Assignment

Implement an **Evolution Strategy** (ES) in MATLAB according to the generational ES algorithm that search for a **real-valued vector of length 30**, which represents the thickness of each layer in a 30-layered optical system. Test the performance, please use ***30,000*** function evaluations for each run, and report on your results ***averaged over 20 runs*** per approach. For the detailed explanation of the problem, please check the course website (http://liacs.leidenuniv.nl/~csnaco/EA/wc/WC5.pdf?v=15-11-2017).

**Deadline: Wednesday 13 December 2017, 23.59.**

Your submission should consist of two files (no more, no less): a report in PDF format (≥3 pages) and your GA implementation in MATLAB. These are to be
sent by email to f.ye@liacs.leidenuniv.nl

Read carefully the *MATLAB Implementation Details* and the *Report Structure Guidelines* provided below.

**PA2.zip** containing all files mentioned can be downloaded from http://liacs.leidenuniv.nl/EA/pa/PA2.zip.

Once again, the experiment settings are:

- Evaluation budget: ***30,000***
- ***20*** independent runs

### MATLAB Implementation Details

Your GA implementation should be a **single** .m file named ***lastname1_lastname2*_es.m** (replacing lastname1 and lastname2 by your own last names) and should be structured as follows:

```
function [xopt, fopt] = lastname1_lastname2_es(eval_budget)

…

end
```

Here, *eval_budget* is the number of function evaluations that the ES is allowed to use per run (i.e., the allowed number of calls to **optical.m**, see below, not the number of generations!), *xopt* is the best vector found by the algorithm, and *fopt* the associated fitness value.

The objective function is provided. To invoke it:

```
Fitness = optical(x);
```

We will compare all submissions using an automated script, this requires all ***plotting, printing to the command line etc. to be disabled*** in the submitted version of your work!

## Some References for Further Reading

- Optical Coating

## Report Structure Guidelines (~4 pages)

**Title + Authors (names, email addresses, and student numbers)**

**Introduction**

*Introduction text here.*

**Problem Description**

*Brief description of the optimization problem here.*

**Implementation**

*Outline of your algorithm, algorithm parameters, and settings used for those parameters. Make sure that the algorithm and the results are reproducible from your description.*

*In case you implement advanced/experimental algorithm components (e.g., parameter tuning), please do report them in detail.*

**Experiments**

*Description of the experiments and the results.*

***Optional**: In case you have tuned the parameters of ES, please use the following tables to summarize the results:*

| Para. settings | Avg | Std dev |
|---|---|---|
| 1 | | |
| 2 | | |
| 3 | | |
| 4 | | |
| … | | |

*In general, please use the figure below to report your results.*

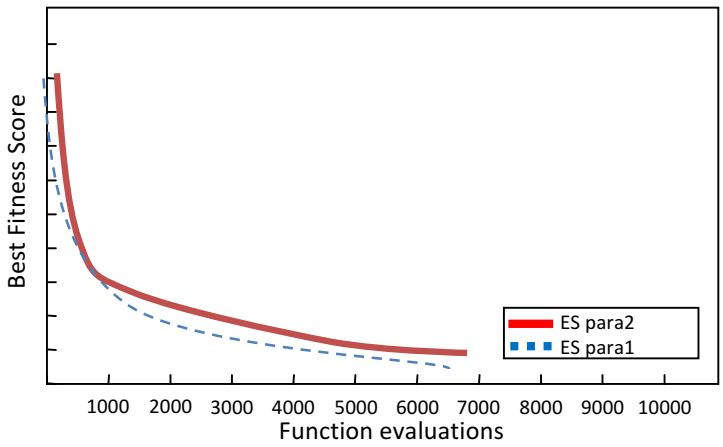


Figure 1: Convergence plot using 30,000 function evaluations, averaged over 20 runs

*Make sure to present your results in a way that is convenient to the reader, do not blindly include plots of all your experiments, try to combine data in figures!*

**Discussion and Conclusion**

*Summarize the results and conclude your report.*