# HW1 - GA in Numerical Optimization

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*Index Terms*—**surface roughness, evolutionary computation, data-driven optimization, machining**

## I. OBJECTIVES

Practice and get familiar with the most widely used evolutionary algorithm — genetic algorithm (GA). In this assignment you need to make use of the taught subject matters about GA's representation, crossover, mutation, and survivor to solve the given problem.

## II. PROBLEM DESCRIPTION

Write efficient programs to implement GAs to find the minimal solution of the Schwefel function (SCH):

$$f_{SCH}\left(\vec{x}\right) = 418.98291N - \sum_{i=1}^{N} x_i \sin\left(\sqrt{|x_i|}\right)$$

where $-512 \leq x_i \leq 511$ and N = 10. This function is a continuous, multimodal, non-convex, deceptive, and N-dimensional function with a global minimum of 0.

TABLE I
GA PARAMETERS

|  | Binary GA | Real-valued GA |
|---|---|---|
| Representation | $c_i \in 2^{10}$ | $c_i \in \mathbb{R}$ |
| Population | Generation (size 100) | |
| Parent Selection | Tournament Selection($n = 2$) | |
| Crossover ($p_c = 0.9$) | Uniform | |
|  | 2-point | Whole-Arithmetic |
| Mutation ($p_m = 1/l$) | Bit-flip | Uniform |
| Survivor Selection | $\mu + \lambda$ | |
| Termination | 500 generations | |

## III. IDEAS

對加工資料進行資料前處理,篩選出關鍵因子,再利用Data-Driven Evolutionary Optimizer建立加工參數與加工震動的資料庫,供未來智慧製造在加工時能對加工狀態有即時預測之功能。

## IV. PROS & CONS

### A. Pros

- 及時狀態預測
- 震動異常顯示

### B. Cons

- 需大量資料才可建立足夠信賴之model

## V. EXPECTED RESULT

建立一model能將加工參數與及時震動資料進行預測出預期加工品質。

## REFERENCES

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