

Constraint-Handling in Evolutionary Algorithms

Jiří Kubalík

Czech Institute of Informatics, Robotics and Cybernetics
CTU Prague



<http://cw.felk.cvut.cz/doku.php/courses/a0m33eoa/start>

Dynamic Penalty

Penalty functions in which the **current generation number is involved in the computation of the corresponding penalty coefficients**.

Typically, the penalty coefficients are defined in such a way that **they increase over time** pushing the search towards the feasible region.

The approach from [Joines94] evaluates individuals as follows:

$$fitness(x) = f(x) + (C \times t)^\alpha \times SVC(x)$$

where t is the generation number and C and α are user-defined constants; recommended values are $C = 0.5$ or 0.05 , $\alpha = 1$ or **2**.

$SVC(x)$ is defined as:

$$SVC(x) = \sum_{i=1}^m G_i(x) + \sum_{j=1}^p H_j(x)$$

where $G_i(x)$ and $H_j(x)$ are functions of the constraints violation ($g_i(x)$ and $h_j(x)$).

Step-wise non-stationary penalty function increases the penalty proportionally to the generation number. The goal is to allow the GA to explore more of the search space before confining it to the feasible region.

Stochastic Ranking + DE

Stochastic ranking coupled to differential evolution

- Solutions (vectors) are ranked with SR before the DE operators are applied.
- The population is split into two sets based on SR
 1. **Vectors with the highest ranks** (Q_1) - from this set the **base vector**, r_1 , and the vector which determines the **search direction**, r_2 , are chosen at random.
 2. **Remaining vectors** (Q_2) - the other vector, r_3 , is chosen at random from this set.



