

Methodology for Parameters Optimization for an Hybrid Architecture of Control

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Cooperative mobile robotics

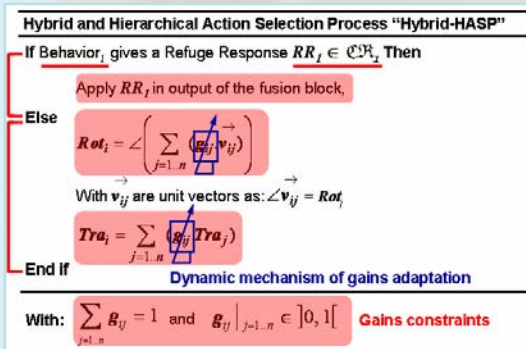
The goals:

- Obtaining more *reliable*, *robust* and *flexible* control for high dynamic mobile multi-robotics systems,
- Obtaining efficient mechanisms of cooperation between robots,
- Mastering local interaction between robots to obtain desired masse effects.

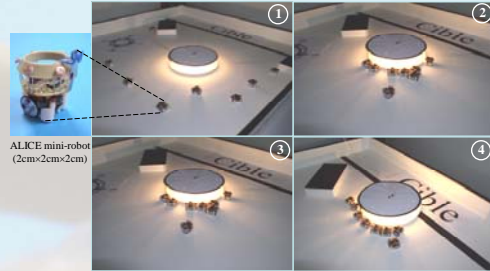
The investigated approach:

- To advantage the use of *minimalist* mobile robotics structure and the use of *low-level mechanism* of cooperation between robots in order to master better a large group of robots,
- The use of *distributed* and *reactive* architecture of control,
- The use of *statistical studies* in order to evaluate the efficiency of the proposed controls.

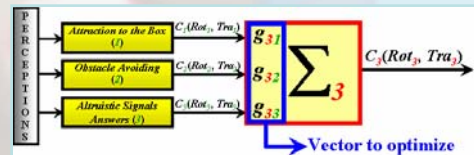
Behavioral architecture of control



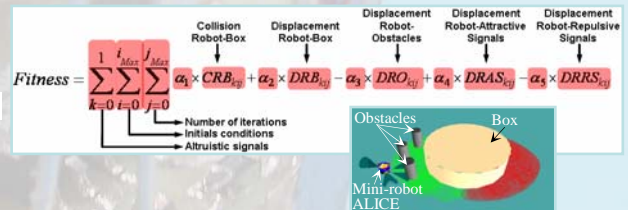
Experimental platform



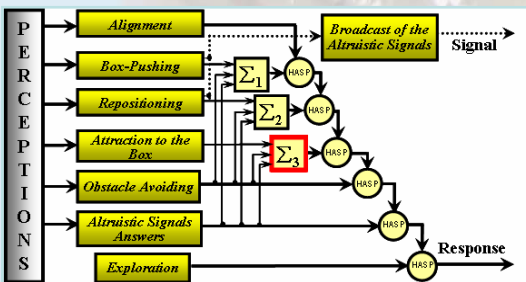
Genetic algorithm optimization



Evaluation



Cooperative box-pushing task



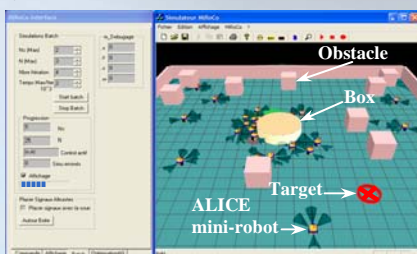
Elementary behaviors



High interactions between robots "avoiding versus aggregation"

Low-level communications between robots

MiRoCo, an accurate simulator for swarm robotics



Crossover operator

$$x = \langle x_1, x_2, x_3 \rangle \rightarrow x' = \langle x'_1, x'_2, x'_3 \rangle$$

$$y = \langle y_1, y_2, y_3 \rangle \rightarrow y' = \langle y'_1, y'_2, y'_3 \rangle$$

With: $\begin{cases} x'_i = sx_i + (1-s)y_i \\ y'_i = (1-s)x_i + sy_i \end{cases}$

s : called *stride* and is randomly chosen between $[0, 0.5]$

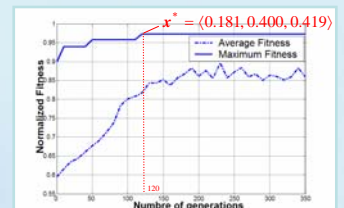
Mutation operator

Assign 0 or 1 randomly

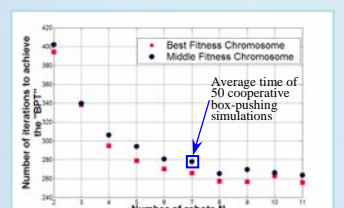
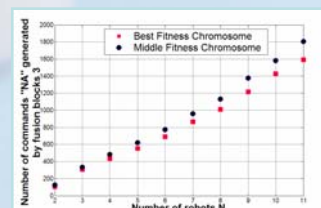
$$x = \langle x_1, x_2, x_3 \rangle \xrightarrow{\text{Normalization}} x_{i=1..3} = \frac{x_i}{\sum_{j=1}^3 x_j}$$

The optimization

- ✓ Population = 1000 chromosomes
- ✓ Crossover probability = 0.8
- ✓ Mutation probability = 0.02



Results evaluation



Perspective

Toward multiobjective and on-line parameters optimization.