# Parametric Study to Enhance Genetic Algorithm's Performance when Using Transformation

## Anabela Simões

Department of Informatics and Systems Engineering Coimbra Polytechnic Quinta da Nora, 3030 Coimbra, Portugal abs@isec.pt

# **Extended Abstract**

Transformation is a biologically inspired genetic operator that, when incorporated in the standard Genetic Algorithm replacing crossover, can promote diversity in the population (Simões and Costa 2001). The computational mechanism mimics the biological process and consists in the capacity of the individuals to absorb fragments of DNA from the environment. These gene segments are then reintegrated in the individuals' genome (see figure).



We have done an extensive empirical study carried to determine the best parameter setting to use with transformation in order to enhance the GA's performance. These parameters include the gene segment length, the replacement rate (percentage of individuals of the previous population used to update the gene segment pool), and the mutation and transformation rates.

The tests were made in two domains: function optimization (minimization) and combinatorial optimization (maximization). The chosen functions were: Ackley, Griewangk, Rastrigin and Schwefel and the 0/1 Knapsack problem (0/1 KP) for combinatorial optimization.

The tables below show the results obtained with, and without, the best parameters settings, for the case of function optimization and for the 0/1 knapsack.

### Ernesto Costa

Centre for Informatics and Systems of the University of Coimbra Polo II, Pinhal de Marrocos, 3030 Coimbra Portugal ernesto@dei.uc.pt

Parametric Study				Random Choice of Parameters				
Segment length=5				Segment length=random				
Replacement Rate=90%				Replacement Rate=90%				
Transformation Rate= 70%				Transformation Rate= 70%				
Mutation Rate=0.0%				Mutation Rate=0.1%				
N° evals->	50000	100000	200000	N° evals->	50000	100000	200000	
Ackley	2.678	0.044	0.002	Ackley	3.128	0.300	0.002	
Griewangk	0.001	0.000	0.000	Griewangk	0.010	0.003	0.001	
Rastrigin	8.290	0.821	0.001	Rastrigin	38.401	18.828	6.540	
Schwefel	0.147	0.031	0.008	Schwefel	36.212	0.475	0.077	

Paran	netric Stu	dy	<b>Random Choice of Parameters</b>			
Segment leng	gth=5		Segment length=random			
Replacement	Rate=50%	ó	Replacement Rate=90%			
Transf. Rate=	= 90%		Transf. Rate= 70%			
Mutation Rat	e=0.0%		Mutation Rate=0.1%			
Pop size->	50	100	Pop size->	50	100	
50 items	204.60	204.90	50 items	197.30	197.80	
100 items	442.50	444.47	100 items	413.00	408.40	
250 items	955.20	954.60	250 items	838.50	834.87	
500 items	1926.87	1910.00	500 items	1666.20	1669.07	

As we can see, choosing the GA parameters with some criteria, the results obtained were quite better than the results achieved in our initial work.

#### Acknowledgments

This work was partially financed by the Portuguese Ministry of Science and Technology under the Program POSI.

#### References

A. Simões, E. Costa (2001). On Biologically Inspired Genetic Operators: Using Transformation in the Standard Genetic Algorithm. Proceedings of the Genetic and Evolutionary Computation Conference (GECCO'2001), pp. 584-591, San Francisco, USA, 7-11 July, Morgan Kaufmann Publishers, 2001.