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EDITORIAL

Special issue on nature inspired cooperative strategies for optimization

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Biological and natural processes have always been a source of inspiration to the basic and applied sciences. Computer science is, perhaps, one of the best examples that illustrate the above point. For example, the powerful ideas of natural selection and survival of the fittest are the driving forces on evolutionary algorithms. Similarly, artificial immune systems, ant colony optimisation, automated self-assembling programming, membrane computing, etc. also have their roots in natural phenomena.

This special issue collects a selection of the best papers emerging from the III International Workshop on Nature Inspired Cooperative Strategies for Optimization 2008 (NICSO), that was held in Tenerife, Spain, 2008.

The NICSO workshop series and its associated publications have been actively helping to advance the state of the art in Nature inspired cooperative strategies for optimisation since its inception in 2006. Computational studies in adaptive behavior, amorphous computing, artificial life, ant colonies optimisation, artificial immune systems, swarm intelligence, software self-assembly and self-organisation, evolutionary algorithms, neural networks, etc. and their application to numerical, combinatorial, non-linear, dynamic and/or noisy optimisation are some, but not all, of the main themes covered by NICSO.

Following the advice of NICSO's International Programme Committee, an open call for papers was issued and the workshop's participants were invited to submit extended versions of their contributions. After reviewing, four contributions were selected to make up this special issue. We summarize below these contributions.

In *A cooperative strategy for solving dynamic optimization problems* by Juan R. González et al., the authors propose a new centralized cooperative strategy based on trajectory methods (tabu search) for solving Dynamic Optimization Problems. The proposed strategy is compared with two decentralized cooperation schemes: an implicit scheme based on Particle Swarm Optimization and an explicit scheme where multiple agents cooperate to improve a grid of solutions. The computational experience shows that the proposed method is able to improve the results obtained with the two other procedures.

A new mechanism to induce diversity in a multi-objective ant colony optimisation algorithm to solve a real-world time and space assembly line balancing problem is presented by Manuel Chica et al. The problem considers two conflicting criteria which must be jointly minimized: the number and the area of the stations given a fixed cycle time limit. The performance of the proposed method is analyzed using ten real-like problem instances and a real-world instance from the Nissan plant in Barcelona (Spain).

In *Decentralized communication, trail connectivity and emergent benefits of ant pheromone trail networks* by Duncan E. Jackson et al., the authors model the trail-based foraging strategy of Pharaoh's ants to understand the limits and constraints of a specific group foraging strategy. Pharaoh's ants exploit the geometry of trail networks bifurcations to make U-turns, if they are walking the wrong way.

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The authors determine that behaviourally heterogeneous populations of agents, where a small minority of agents make frequent U-turns, have greater colony foraging success than homogeneous colonies with a low level of U-turns. The decentralised information transfer might ensure that foragers can respond to dynamic changes in food distribution.

The frequency assignment problem is one of the most important problems in the design of GSM (Global System for Mobile Communications) networks. In the paper *Parallel hyperheuristics for the frequency assignment problem* by Carlos Segura et al., a hybrid model which combines a parallel island-based scheme with a hyperheuristic approach is presented to solve this problem. The hyperheuristic approach is used to manage the choice of which lower-level algorithm configuration is executed on each island at each optimization stage. The computational results demonstrate the validity of the proposed model.

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