

Other Works in Bio-inspired Strategies and Grid

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- **Agenda Session**

- *General Introduction (10')*.

Miguel Cárdenas-Montes.

- *Grid-Based Metaheuristics Applied to Nuclear Fusion (15')*.

Antonio Gómez-Iglesias.

- *DIOGENES: Application Oriented Task Scheduling Using Genetic Algorithms (15')*.

Florin Pop.

- *Other works in bio-inspired strategies and grid (10')*.

Miguel Cárdenas-Montes.

- *Questions (10')*.

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 - Vicente Hernández, Germán Moltó.
- **Universidad de Extremadura**
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 - Francisco Herrera.

Optimization of Supercontinuum Spectrum Using Genetic Algorithms on Service-Oriented Grids

- **Objective:**
 - Optimization of photonic crystal fibers.
- **The problem:**
 - The generation of optical homogeneous spectra covering a range from the near infrared to the ultra violet is know as Supercontinuum generation. This phenomenon is usually observed in photonic crystal fibers.
 - Applications have been found in optical metrology pulse compression and white light sources generation.
 - Focus on nonlinear microscopy of biological samples.

G. Moltó et al. / 3rd Ibergrid. (2009) 143 – 150

Optimization of Supercontinuum Spectrum Using Genetic Algorithms on Service-Oriented Grids

- **The difficulties tackled:**
 - Computationally expensive – fourth order Runge-Kutta method, plus fast Fourier transform or inverse fast Fourier transform
 - The exploration of the entire solution space is unfeasible.
- **The bio-inspired algorithm:**
 - Genetic Algorithm
- **Results:**
 - Finding of set of parameters that correspond to configurations where an important fraction of the final spectrum falls into the desired range.

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Grid Computing for Solving a Real-World FAP Problem

- **Objective:**
 - Minimize the number of interferences caused in the assignment of a limited number of frequencies to a high number of transceivers.
- **The problem:**
 - Frequency planning (Frequency assignment problem – FAP) is a very important task for GSM operators. The problem consists in trying to minimize the interferences caused when a limited number of frequencies have to be assigned to a high number of transceivers.

José G. Chaves-González et al. / 9th International Workshop on State-of-the-Art in Scientific and Parallel Computing. (2008)

José G. Chaves-González et al. / Solving a Realistic FAP using GRASP and Grid Computing / 4th Advances in Grid and Pervasive Computing. (2009)

Grid Computing for Solving a Real-World FAP Problem

- **The difficulties tackled:**
 - High number of experiments.
 - Realistic and accurate interference information from a real-world GSM network used.
 - NP-Problem.
- **The bio-inspired algorithm:**
 - PBIL – Population-based Incremental Learning (Estimation of Distribution Algorithm).
- **Results:**
 - Reduction for the interferences down to satisfactory levels – Quality of Services previously established.

José G. Chaves-González et al. / 9th International Workshop on State-of-the-Art in Scientific and Parallel Computing. (2008)

Conjecture of Bateman Solver with Particle Swarm Optimisation and Grid Computing

- **Objective:**

- Search more coincidences of Conjecture of Bateman.

- **The problem:**

$$\sum_{i=0}^m p_1^i = \sum_{i=0}^n p_2^i \quad \begin{cases} 31 = \sum_{m=0}^4 2^m = 1 + 2^1 + 2^2 + 2^3 + 2^4 \\ 31 = \sum_{n=0}^2 5^n = 1 + 5^1 + 5^2 \end{cases}$$

- **The difficulties tackled:**

- Systematic survey.
- Previously, for all primes minor than 15,000,000 (until 14,999,981) and powers until 30, 11,325 jobs and 16,957 CPU-h.
- Not end problem.

M. Cárdenas-Montes et al. / 8th ISPDC. (2009) 143 – 150

Conjecture of Bateman Solver with Particle Swarm Optimisation and Grid Computing

- **The bio-inspired algorithm:**
 - Standard Particle Swarm Optimization
- **Results:**
 - No more coincidences found in the search space: primes until 1,000,000 and powers until 40.

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Grid Computing in Chess Endgames

- **Objective:**
 - To train a system able to play chess endgames and win.
- **The problem:**
 - To implement an algorithm to resolve chess problems emulating a human chess player.
- **The difficulties tackled:**
 - The size of the solution space.
 - The amount of information existing on the board.

A. Gómez-Iglesias et al. / 2nd IBERGRID (2008) 227 – 238

Grid Computing in Chess Endgames

- **The bio-inspired algorithm:**
 - Genetic algorithm.
- **Results:**
 - A competitive system that evolves from bad initial results into good ones after a training period.
 - Great improvement in relation to the sequential version.

A. Gómez-Iglesias et al. / 2nd IBERGRID (2008) 227 – 238

Experimental Study of PSO algorithms performance

- **Objective:**
 - Measure the performance of diverse enhancements proposed to standard PSO.
- **The problem:**
 - PSO have two major drawbacks: particles clustering and stagnation of the fitness improvement.
- **The difficulties tackled:**
 - Not systematic studies: different configuration (population size, generations, algorithms parameters), different function fitness.
 - Best cases always proposed.
 - Large setup: 24 configuration, 9 fitness function, SPSO + 5 enhancements.

$24 * 9 * 6 * 500$ (trials) = 648,000 (trials); or 12,960 jobs.

Experimental Study of PSO algorithms performance

- **The bio-inspired algorithm:**
 - Particle Swarm Optimization (with enhancements)
- **Results:**
 - A clear and experimental ranking of performance of PSO algorithms.

To be published

- **General Conclusions**

- Bio-inspired algorithms are very suitable for grid computing paradigm.
- The works presented show good synergies between different scientific-technical areas and bio-inspired algorithms.
- Relevant scientific results are achieved as a result of the essential participation of the bio-inspired algorithms.
- Some bio-inspired algorithms are ubiquitous: different algorithms can be used for the same problem (GA, PBIL, PSO, DE).

- **Thanks.**
- **Gracias.**

- **Questions?**
- **More Questions?**