~~~ Call for Papers ~~~
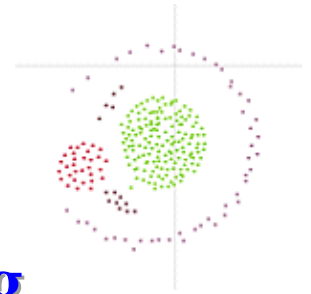
A Special Session on

Morphogenetic Engineering

In ANTS 2010: Seventh International Conference on Swarm Intelligence

September 8–10, 2010
Université Libre de Bruxelles, Brussels, Belgium
http://iridia.ulb.ac.be/ants2010

Aim and Scope

Engineered products are generally made of a number of unique, heterogeneous components assembled in a precise and complicated way, and work deterministically following the specifications given by the designers. By contrast, self-organization in natural systems (physical, biological, ecological, social) often relies on the repetition of identical agents and stochastic dynamics. Nontrivial behavior can emerge from relatively simple agent rules—a fact often touted as the hallmark of complex systems. However, most natural patterns (spots, stripes, waves, trails, clusters, hubs, etc.) can be described with a small number of statistical variables. They are either random or shaped by boundary conditions, but never exhibit an *intrinsic architecture* like engineered products do.

One monumental exception is biological development. Morphogenetic processes demonstrate the possibility of combining pure self-organization *and* elaborate structures. Multicellular organisms are composed of segments and parts arranged in specific ways that might resemble the devices of human inventiveness. Yet, they entirely self-assemble in a decentralized fashion, under the guidance of genetic and epigenetic information spontaneously evolved over millions of years and stored in every cell. In other words, they are examples of *programmable self-organization*—a concept not sufficiently explored so far, neither in complex systems science (for the "programmable" part), nor in traditional engineering (for the "self-organization" part). How do biological organisms achieve morphogenetic tasks so reliably? Can we export their self-formation capabilities to engineered systems? What would be the principles and best practices to create such morphogenetic systems?

Following the success of the First Morphogenetic Engineering Workshop held in Paris in June 2009, this special session aims to establish a new field of research "Morphogenetic Engineering", which explores the artificial design and implementation of autonomous systems capable of developing complex, heterogeneous morphologies without central planning or external drive. Particular emphasis is set on the mutual relationship between programmability/controllability and self-organization, an issue that is often under-appreciated in many disciplines.

Topics of Interest

Original, high-quality papers on Morphogenetic Engineering are solicited to this special session. Relevant topics include, but are not limited to:

- New principles of morphogenesis in artificial systems
- Swarm-based approaches to morphogenetic systems
- Programmability of self-organizing systems/self-organization of programmable systems
- Design techniques for morphogenetic engineering
- Sensitivity to environment vs. endogenous drive
- Evolvability, by variation and selection, of morphogenetic systems
- Bio-inspiration from "evo-devo": combining evolutionary computation with artificial development
- Applications to real-world problems (nanotechnologies, reconfigurable robots, swarm robotics, techno-social networks, etc.) and physical implementation

Paper Submission

This special session will be held as part of *ANTS 2010: Seventh International Conference on Swarm Intelligence*. Papers should be submitted through the conference's online submission system. For more information, see its website http://iridia.ulb.ac.be/ants2010

Accepted papers will be included in Conference Proceedings (very likely published by Springer in the LNCS series) and distributed to the participants at the conference site. The journal *Swarm Intelligence* will publish a special issue with extended versions of the best research works.

Important Dates

Submission deadline:	**February 28, 2010**
Notification of acceptance:	April 30, 2010
Camera ready copy:	May 14, 2010
Conference:	September 8-10, 2010

Session Chairs

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