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Nonlinear Systems Optimization and Statistics group

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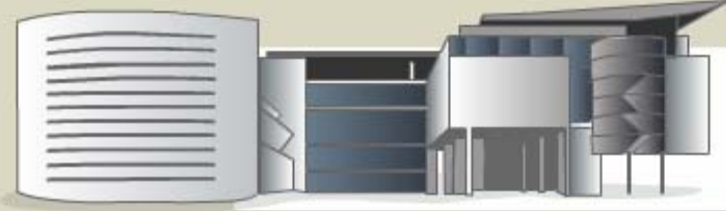
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16 January 2008



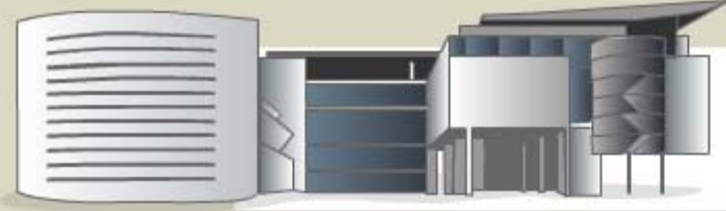
## Research Interests

- **Stochastic algorithms for global optimization**
  - Electromagnetism-like algorithm
- **Mixed integer programming**
  - Approximated solutions
  - Heuristics
- **Swarm intelligent algorithms**
  - Future challenges



## Swarm Intelligence

1. Swarm intelligence (SI) is an artificial intelligence algorithm based **around the study of collective behaviour** in decentralised, self-organised, systems.
2. Swarm intelligence systems are usually made up of a **population of simple agents interacting locally with one another and with their environment.**
3. Swarm intelligence techniques are population-based **stochastic methods** used in combinatorial/continuous optimization.



## Swarm Intelligence

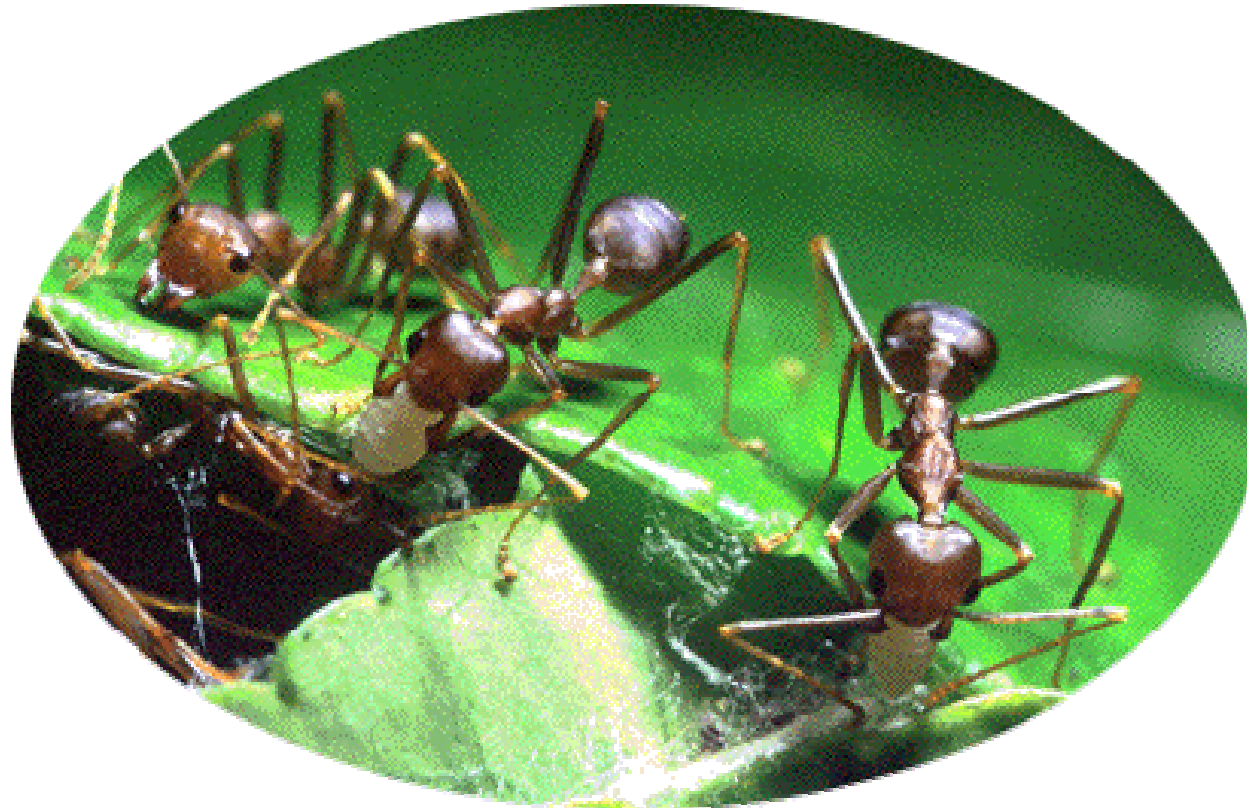
Natural examples of SI systems include:

- ant colonies,
- bird flocking,
- animal herding,
- bacterial growth,
- fish schooling



## Swarm Intelligent algorithms

- Ant Colony Optimization algorithm





## Swarm Intelligent algorithms

- Particle Swarm Optimization algorithm





# Swarm Intelligent algorithms

- Bees Algorithm





## Swarm Intelligent algorithms

- Artificial Fish Swarm Algorithm







## Applications of Swarm Intelligence

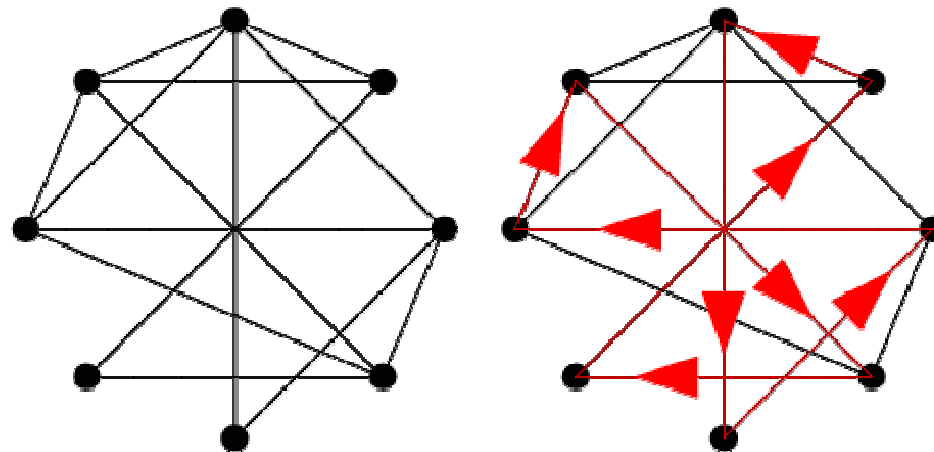
Swarm Intelligence-based techniques

- offer to researchers and scientists a tool for solving NP complete problems
  - **Traveling salesman problem (TSP)**
- can be used in a number of practical real world applications such as **traffic routing, networking, games, industry, robotics, etc.**



## Traveling Salesman problem

The TSP is the problem of finding a route of a salesman who starts from a home location, visits a prescribed set of cities and returns to the original location in such a way that the total distance traveled is minimum and each city is visited exactly once.





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## PhD Thesis Proposal

### Performance Analysis of Swarm Intelligent Algorithms on the Traveling Salesman Problem

#### Objectives:

Analyze and implement several swarm intelligent systems, select the most appropriate and develop a specific algorithm to solve the TSP problem, as well as to compare its performance with approximate and exact methods known in the literature.

#### Supervisors:

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