

University of Waterloo
Faculty of Engineering
Department of Electrical and Computer Engineering

ECE 493 Sec 5: Cooperative and Adaptive Algorithms
3C, 1T

Instructor: Mohamed Kamel, EIT 4136, mkamel@uwaterloo.ca

Calendar Description:

The course introduces the concepts of cooperation and adaptations and how they are influencing new methods for solving complex problems. The course starts by illustrating how the concepts of cooperation and adaptation are manifested in nature and how such models are inspiring new types of solutions methods. Topics to be covered include: search algorithms, meta-heuristics, evolutionary computing methods, swarm intelligence, ant-colony algorithms, particle swarm methods, adaptive and learning algorithms and the use of these algorithms in solving continuous and discrete problems that arise in engineering applications.

Prerequisite:

ECE 250 or SE 240 Algorithms and data Structures, ECE316 Probability Theory and Random Processes or equivalent.

Course Text (optional):

Fundamentals of Computational Swarm Intelligence, Andries P. Engelbrecht, Wiely and Sons, 2006.

Evaluation:

30% Assignment

20% Midterm

50% Final exam

Major Topics:

1. Introduction to cooperation and adaptation in nature and computational models inspired by nature.
2. Heuristic search methods: A*, Tabu search, cooperative search.
3. Simulated annealing, Genetic algorithms, cooperation in GA.
4. Ant Colony algorithms: ACO- cooperative and multi-ant-colonies .
5. Particle swarm algorithms: particle swarm optimization, cooperation within the swarms, cooperation among swarms, swarm ensembles.
6. Engineering Applications: optimization, routing, text clustering.