PhD project available

School of Engineering and Information Technology,
The University of New South Wales,
Australia, www.unsw.adfa.edu.au

Project Title: Development of optimization methods for many-objective optimization
Supervisors: Professor Tapabrata Ray
Degree: PhD in Mechanical Engineering / Computer Science

Project description:
Multi-objective Optimization (MO) problems are those which involve more than one conflicting objectives to be maximized/minimized. Such problems occur frequently in engineering design, and development of efficient algorithms for MO is a highly active field of research. *Many-objective optimization (MaO)* problems are further differentiated as the MO problems which contain four or more objectives.

MaO problems are significantly challenging compared to 2-3 objective problems for a number of reasons:
(1) The foremost is that Pareto-dominance/non-domination principle, which forms the key ranking procedure for evolutionary multi-objective algorithms scales poorly beyond 2-3 objectives. Thus, there is a loss of selection pressure required to drive the solutions towards the Pareto-optimal front (POF). As a result, the convergence to POF is not achieved even after exorbitant computational effort.
(2) The number of solutions required to cover the POF grows exponentially with number of objectives. Thus it becomes increasingly challenging to achieve a good representation of the POF using a finite set of solutions.
(3) There is no definitively established way of visualizing POF of MaO problems, since they contain more than three dimensions. Therefore, selection of final solutions for implementation from the POF is not straightforward.

This research aims to address above issues through development of effective *decomposition based algorithms* and appropriate metrics for identifying solutions of interest. Decomposition based algorithms is a general class of algorithms which have shown significant promise in solving MaO problems in recent years. However, a number of open problems remain in terms of the strategies used within this general framework, the primary ones being selection and adaption of “reference directions” along which the problem is decomposed.

Required Background:
Good programming (Matlab, C/C++) and analytical skills, preferably with a Masters Degree in Engineering / Computer Science. Prior research experience in optimization is desirable but not necessary. Demonstrated competence in academic writing and oral presentation skills will be beneficial. Must meet UNSW admission criteria and English Language requirements.

Expected joining:
At the earliest. Please send scanned copies of transcripts and CV to t.ray@adfa.edu.au

For more information:
About our Multi-disciplinary Design Optimization (MDO) group, please visit our website:
http://www.mdolab.net/index.html

About recent work in MaO field, refer to this repository:
http://www.mdolab.net/Resources/mao_repository_main.html