Keynote Speaker-2:

Advances in Particle Swarm Algorithms in Asynchronous, Discrete and Multi-Objective Optimization

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This lecture presents the latest advancement of Particle Swarm Optimization (PSO) in asynchronous update, discrete, and multi-objective problems. PSO is a population based stochastic optimization algorithm, inspired by the social behavior of bird flocking and fish schooling. PSO has been introduced by Kennedy and Eberhart and contains a group of particles that move in a search space searching for an optimum solution according to a particular objective function. The movement of a particle is subjected to its own best found solution, pBest, and the best found solution in the neighborhood, gBest.

Synchronous Asynchronous Particle Swarm Optimization

Originally, PSO was introduced as a synchronous update algorithm (S-PSO), where the particles velocity and position are updated after the whole swarm performance is evaluated. Asynchronous update in PSO has been explored recently. A particle in asynchronous PSO (A-PSO) updates its velocity and position as soon after its own performance is evaluated. In this paper, we attempt to improve PSO by merging both synchronous and asynchronous update in the search process. The proposed algorithm, which is named as, Synchronous – Asynchronous PSO (SA-PSO), divides the particles into smaller groups. The best member of the group and the swarm's best are chosen to lead the search. The members of the group are updated synchronously while the groups are asynchronously updated. Five well known unimodal functions and four multimodal functions are used here to study the performance of the proposed algorithm. The performance of the algorithm is compared with three existing PSO algorithms. The results show that the proposed algorithm is able to consistently produce good optimal solutions.

Multi-State Particle Swarm Optimization

A new version of PSO for discrete optimization problem called multi-state particle swarm optimization (MSPSO) is introduced. The MSPSO algorithm works based on a simplified mechanism of transition between two states. In order to avoid the repetitive states, a rule is embedded in the MSPSO algorithm. The performance of the MSPSO is emperically compared to original and BPSO based on six sets of selected benchmarks instances of traveling salesman problem (TSP). The experimental results showed the effectiveness of the newly introduced approach, regarding its ability to consistently outperforms the binary-based algorithms in solving the discrete optimization problem.

Multi-Leaders Dominance-based Vector Evaluated Particle Swarm Optimization

The Vector Evaluated Particle Swarm Optimisation (VEPSO) algorithm has been widely used in solving multi-objective optimisation problems. In the VEPSO algorithm, particles of a swarm use the best solution found by their neighbourhood swarm to guide their movement. Due to its simplicity, the VEPSO mechanism is not capable in producing good solutions for multi-objective optimisation problems. Hence, dominance and multi leaders concept are introduced to improve the VEPSO algorithm. The improved VEPSO is measured by the number of non-dominated solutions found, Generational Distance, Spread, and Hypervolume. This analysis shows that improved VEPSO signicantly improves upon the original VEPSO algorithm.

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Speaker's Biography

Dr Zuwairie Ibrahim received his B.Eng (Mechatronics) and M.Eng. (Image Processing) from Universiti Teknologi Malaysia, in 2000 and 2002,respectively. In 2006, he has been awarded a PhD (DNA Computing) from Meiji University, Japan. In 2002 to 2012, he was engaged with the Department of Mechatronics and Robotics, Faculty of Eletrical Engineering, Universiti Teknologi Malaysia, as a lecturer. Dr Zuwairie Ibrahim is currently an Associate Professor in the *Faculty of Electrical and Electronic Engineering, Universiti Malaysia Pahang*. He is the co-author of the book entitled *Bioevaluation of World Transport Networks*, published by World Scientific in 2012. He has been appointed to the Editorial of *International Journal of Simulation: Systems, Science, and Technology (IJSSST)* by UK Simulation Society and *Jurnal Elektrika* by Faculty of Electrical Engineering, Universiti Technologi Malaysia. He is also has been appointed as visiting researchers in universities in Japan and Malaysia. He is an author/co-author of more than 50 publications in international journals and more than 100 publications in conferences. His research interests include computational intelligence, image processing, and unconventional computation such as molecular or DNA computing.

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