Area: Power and Energy Systems (PES)

Host: Prof Dipti Srinivasan

This seminar is co-organized by GEMS, ECE, NUS and IEEE CIS Singapore Chapter.

TOPIC	:	**Direct Measuring of Exploration and Exploitation in Evolutionary Algorithms using Attraction Basin-based Measures**
SPEAKER	:	**Prof Marjan Mernik** **Professor, University of Maribor, Slovenia** **Former Visiting Professor, University of Alabama at Birmingham**
DATE	:	**Tuesday, 17 March 2026**
TIME	:	**3:00PM-5:00PM**
VENUE	:	**Engineering Auditorium, National University of Singapore**

ABSTRACT

Evolutionary algorithms mimic natural processes such as selection, crossover, and mutation to solve a wide range of optimization problems. Effective application of these algorithms requires a solid understanding of the various selection, crossover, and mutation operators. However, exploration and exploitation are fundamental processes—and arguably the most critical concepts—for any search algorithm. Despite their importance, these concepts are not yet well understood among many researchers and practitioners. Furthermore, the direct measurement of exploration and exploitation remains an open problem in evolutionary computation.

This talk first introduces the basic components of evolutionary algorithms, highlights common issues and mistakes encountered by inexperienced users, and discusses their diverse applications. In the second part, a novel direct measure of exploration and exploitation based on attraction basins is presented. Attraction basins are regions of a search space in which each region contains a point, called an attractor, toward which neighbouring points tend to evolve. Each search point can therefore be associated with a specific attraction basin. If a newly generated search point belongs to the same attraction basin as its parent, the search process is considered exploitation; otherwise, it is classified as exploration.

In the final part, the talk demonstrates how the newly developed exploration and exploitation measures can be used to analyze and compare different evolutionary algorithms.

BIOGRAPHY

Marjan Mernik received the MSc and PhD degrees in Computer Science from the University of Maribor in 1994 and 1998, respectively. He is currently a professor at the University of Maribor, Faculty of Electrical Engineering and Computer Science. From 2007 to 2017, he was a visiting professor in the Department of Computer and Information Sciences at the University of Alabama at Birmingham. His research interests include programming languages, domain-specific (modelling) languages, grammar and semantic inference, and evolutionary computations. He is the Editor-in-Chief of the Journal of Computer Languages, as well as an Associate Editor of the Applied Soft Computing Journal and Swarm and Evolutionary Computation Journal. He has been named a Highly Cited Researcher for the years 2017 and 2018. More information about his work is available at https://lpm.feri.um.si/en/members/mernik/.

https://cde.nus.edu.sg/ece/highlights/events/