

## SSCI'17 Tutorial:

# Recent Advances in Decomposition Based Multi-objective and Many-objective Evolutionary Algorithms

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### Abstract

In the last decade, the framework which has attracted the most attention of researchers in the evolutionary multi-objective optimization community is the decomposition-based framework. Decomposition is a well-known strategy in traditional multi-objective optimization. However, the decomposition strategy was not widely employed in evolutionary multi-objective optimization until Zhang and Li proposed multi-objective evolutionary algorithm based on decomposition (MOEA/D) in 2007. MOEA/D proposed by Zhang and Li decomposes a multi-objective optimization problem into a number of scalar optimization subproblems, and optimizes them in a collaborative manner using an evolutionary algorithm. Each subproblem is optimized by utilizing the information mainly from its several neighbouring subproblems. Since the proposition of MOEA/D in 2007, several studies have been conducted in the literature to: a) overcome the limitations in the design components of the original MOEA/D, b) improve the performance of MOEA/D, c) present novel decomposition-based MOEAs, and d) adapt decomposition-based MOEAs for different type of problems.

Investigations on the decomposition-based framework have been undertaken in several directions, including design of new decomposition approaches, efficient allocation of computational resources, modifications in the reproduction operators, mating selection and replacement mechanism, hybridizing decomposition- and dominance-based approaches, etc. Furthermore, several attempts have been made at extending the decomposition-based framework to many-objective optimization. This tutorial will present a comprehensive survey of the decomposition-based MOEAs proposed in the last decade for multi-objective and many-objective optimization.

### Targeted audience

This tutorial should be of interest to both new beginners and experienced researchers in the area of multi-objective and many-objective optimization. The tutorial will provide a unique opportunity to showcase the latest development on this interesting research topic to the research community.

Attendees will learn about – 1) Multi-objective evolutionary algorithm based on decomposition (MOEA/D), 2) Recent advances in the field of decomposition-based MOEAs, and 3) Future research directions along decomposition-based MOEAs. We expect that the tutorial will be of around 110 minutes.

## Speaker Bio

**Anupam Trivedi** received the Dual degree (integrated Bachelor's and Master's) in Civil Engineering from the Indian Institute of Technology (IIT) Bombay, Mumbai, India, in 2009, and the Ph.D. degree in Electrical & Computer engineering from the National University of Singapore, Singapore, in 2015. Currently, he is a Post-Doctoral Research Fellow at the Department of Electrical & Computer Engineering, National University of Singapore, Singapore. He secured 2<sup>nd</sup> rank for his unified differential evolution algorithm in the CEC 2017 competition on constrained optimization. He is the Vice-Chair of the newly formed Task Force under IEEE CIS on "Decomposition-based Techniques in Evolutionary Computation". His research interests include evolutionary computation, single-objective optimization, multi-objective optimization, and real world optimization.



**Dipti Srinivasan** is a Professor in the Dept. of Electrical & Computer Engineering at the National University of Singapore (NUS), where she also heads the Centre for Green Energy Management & Smart Grid (GEMS). She is an adjunct researcher with the Solar Energy Research Institute of Singapore (SERIS). Over the last twenty years, her contributions have primarily emphasized on the development of advanced computational intelligent-based methods and their practical applications for large complex engineered systems, such as the smart grid and urban transportation systems. She has extensive industry experience, having worked as a design engineer with an Indian utility for three years, and through several projects with Singapore utilities. She has secured over S\$11 Million in external funding for research projects in these areas. Dipti is an active member in IEEE CIS and PES societies, and was awarded the IEEE PES Outstanding Engineer award in 2010. She is currently serving as an Associate Editor of IEEE Transactions on Sustainable Energy, IEEE Transactions on Evolutionary Computation, IEEE Computational Intelligence magazine, and Area Editor of International Journal of Uncertainty, Fuzziness and Knowledge-based Systems.

