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IEEE Transactions on Emerging Topics in Computational Intelligence

Special Issue on Advances in Methodologies for Metaheuristic Algorithms

I. AIM AND SCOPE

Nature-inspired metaheuristic algorithms have skyrocketed in popularity and are widely used in engineering, computer science, artificial intelligence, bioinformatics and increasingly, in many other research areas where there are complex optimization problems to tackle. A main reason for their meteoric rise in popularity is that they require little information about a problem and make no assumptions about its characteristics. Their computer codes are widely available, and they have the ability to frequently find the optimum, or a good approximation of it, for complex optimization problems. They are general purpose algorithms meaning that they can be usually adapted to tackle any type of optimization problem. Interest in these algorithms continues to date unabated with new or modified algorithms proposed on a nearly weekly basis. There are also more journals devoted to solely publishing developments and applications of metaheuristic algorithms.

Metaheuristic algorithms are motivated differently, and so they have empirical properties and varying capabilities to optimize a problem. These algorithms also have stochastic elements and a varying number of tuning parameters whose choices can affect the performance of the algorithm. In practice, the performances of these algorithms are often compared via simulations, which can have serious limitations. Yet, they tend to converge even though they lack a firm theoretical justification, which makes them intriguing. In review or overview articles on metaheuristic algorithms, a common cautionary note is that, while they are very useful in practice, a limitation is that they do not have firm theoretical justifications.

The purpose of this special issue is to address long standing, ubiquitous scientific issues in metaheuristic algorithms. There is recognition that even though metaheuristic algorithms have made remarkable contributions, a greater understanding of their foundational issues is needed before it can create a more impactful footprint. This special issue seeks original papers that provide deeper insights and novel methods to formalize and strengthen metaheuristic algorithms with a more solid theoretical foundation, including developing a general framework to study analytical properties of metaheuristic algorithms and theoretical approaches to solve high-dimensional, multi-objective and multitasking optimization problems. It is expected that papers in the issue will apply the latest analytical tools from statistics, mathematics, computer science and engineering to address key theoretical and computational issues in metaheuristic algorithms, including (but not limited to) the research areas outlined below.

II. TOPICS
- Smart choice of stochastic components, swarm size and stopping criteria with minimal computation cost
- New perspectives on various modes of convergence for metaheuristic algorithms
- Mathematical proofs of convergence to local optima versus global optima
- Theory for large scale optimization problems for accelerated convergence
- A theoretical framework for studying analytical properties of various algorithms
- Modifications of metaheuristic algorithms to ensure their theoretical convergence to the global optimum
- Theoretical balance between exploitation and exploration in metaheuristic algorithms
- New theories for multitasking and many-objectives optimization problems
- Development of theory-based criteria for comparing metaheuristic algorithms
- Automated algorithm configuration
- Runtime analysis
- Hybrids between metaheuristic algorithms and mathematical programming techniques
- Bayesian optimization combined with metaheuristic algorithms
- Performance assessment and performance indicators for multi-objective optimizers based on metaheuristic algorithms

III. SUBMISSIONS

Manuscripts should be prepared according to the "Information for Authors" section of the journal, and submissions should be done through the journal submission website at https://mc.manuscriptcentral.com/tetci-ieee by selecting the Manuscript Type of "Advances in methodologies for metaheuristic algorithms" and clearly marking "Advances in methodologies for metaheuristic algorithms" as comments to the Editor-in-Chief. Submitted papers will be reviewed by at least three different reviewers. Submission of a manuscript implies that it is the authors' original unpublished work and is not being submitted for possible publication elsewhere.

IV. IMPORTANT DATES
Paper submission deadline: December 31, 2023
First round review notice: April 1, 2024
Revision due: June 30, 2024
Final notice of acceptance/reject: September 1, 2024

V. GUEST EDITORS

Carlos Artemio Coello Coello, CINVESTAV-IPN, Departamento de Computación, Mexico
Email: ccoello@cs.cinvestav.mx
Abhishek Gupta, Department of Mechanical Sciences, Indian Institute of Technology, Goa, India
Email: abhishek_gupta@simtech.a-star.edu.sg
Heike Trautmann, Data Science: Statistics and Optimization, University of Münster, Germany / University of Twente, Netherlands
Email: h.trautmann@utwente.nl
Weng Kee Wong, Department of Biostatistics, UCLA, USA
Email: wkwong@ucla.edu