



Special Session & Competitions on Real-World Single Objective Constrained Optimization

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Introduction

Real-world optimization problems have been comparatively difficult due to the complex nature of the objective function with a substantial number of constraints.

In recent years, several metaheuristics as well as constraint handling approaches have been suggested.

To validate the effectiveness and strength, performance of a newly designed approach should be benchmarked by using some complex real-world problems.

Mathematically, a constrained optimization can be defined by

$$\begin{aligned} & \text{Min } f(\bar{x}), \bar{x} = (x_1, x_2, \dots, x_n) \\ & \text{subject to: } g_i(\bar{x}) \leq 0, i = 1, 2, \dots, n_g \\ & \quad \quad \quad h_j(\bar{x}) = 0, j = 1, 2, \dots, n_h \end{aligned}$$

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A review for CEC2020 benchmark problems

A set of 57 real-world constrained problems selected from different real-world applications are considered as a benchmark problems.

Real-world Application	Number of Problems
Industrial Chemical Processes	7 (RC01-RC07)
Process Synthesis and Design Problems	7 (RC08-RC14)
Mechanical Engineering Problems	19 (RC15-RC33)
Power System Problems	11 (RC34-RC44)
Power Electronic Problems	6 (RC45-RC50)
Livestock Feed Ration Optimization	7 (RC51-RC57)

In these problems, the number of decision variables vary from 2 to 158, number of equality constraints vary from 0 to 148, and number of inequality constraints vary from 0 to 91.

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Accepted Algorithms

	Paper ID	Algorithm	Paper Title
1	E-24191	FCHA	Self-tuning Co-Operation of Biology-Inspired and Evolutionary Algorithms for Real-World Single Objective Constrained Optimization
2	E-24363	EnMODE	Multi-Operator Differential Evolution Algorithm for Solving Real-World Constrained Optimization Problems
3	E-24443	BPMAgES	A Modified Matrix Adaptation Evolution Strategy with Restarts for Constrained Real-World Problems
4	E-24537	DEQL	A Differential Evolution Algorithm with Q – Learning for Solving Engineering Design Problems
5	E-24586	COLSHADE	COLSHADE for Real-World Single-Objective Constrained Optimization Problems

Accepted Algorithms

	Paper ID	Algorithm	Paper Title
6	E-24594	VMCH	Voting-mechanism based ensemble constraint handling technique for real-world single-objective constrained optimization
7	COM108	sCMAgES	A Modified Covariance Matrix Adaptation Evolution Strategy for Real-World Constrained Optimization Problems
8	COM109	SASS	A Self-Adaptive Spherical Search Algorithm for Real-World Constrained Optimization Problems

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Evaluation Criteria

$$Score_1$$

$$Score_1 = \sum_{j=1}^{57} w_j \widehat{Af_{ij}^{best}}$$

$$Score_2$$

$$Score_2 = \sum_{j=1}^{57} w_j \widehat{Af_{ij}^{mean}}$$

$$Score_3$$

$$Score_3 = \sum_{j=1}^{57} w_j \widehat{Af_{ij}^{median}}$$

$$Score = 0.5 * Score_1 + 0.3 * Score_2 + 0.2 * Score_3$$




Higher weights are given for higher dimensions.

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- Introduction
- Test problems suite
- Indicators and rules
- Participators
- Comparison method
- **Ranking result**

Ranking Result

Final Ranking of the accepted algorithms

Algorithm	$Score_1$	$Score_2$	$Score_3$	Score	Ranking
FCHA	0.8499	0.9064	0.8931	0.8755	8
EnMODE	0.1846	0.2039	0.2260	0.1986	4
BPMAgES	0.2063	0.2593	0.2687	0.2347	5
DEQL	0.5763	0.5642	0.5426	0.5660	7
COLSHADE	0.0868	0.1690	0.1101	0.1161	2 
VMCH	0.3051	0.2560	0.2710	0.2836	6
sCMAgES	0.1416	0.2073	0.2059	0.1742	3 
SASS	0.0885	0.0689	0.0762	0.0802	1 



Thanks for your attention!