ISSN 2007-9737

Editorial

The continuous further development of powerful optimization techniques is mandatory to cope with our world those complexity is ever increasing. To tackle emerging problems, many researchers and practitioners make use of one of the two following well-established and widely known fields: (i) traditional numerical optimization, also referred to as mathematical programming, or (ii) comparatively recent bio-inspired heuristic search. Both paradigms have their unique strengths and weaknesses, allowing them to solve some challenging problems while still failing in others.

The goal of the NEO (Numerical and Evolutionary Optimization) workshop series is to bring together experts from these and related fields to discuss, compare and merge their complementary perspectives in order to develop fast and reliable hybrid methods that maximize the strengths and minimize the weaknesses of the underlying paradigms. In doing so, NEO promotes the development of new techniques that are applicable to a broader class of problems. Moreover, NEO fosters the understanding and adequate treatment of real-world problems particularly in emerging fields that affect all of us, such as healthcare, smart cities, big data, among many others.

This volume of Computación y Sistemas comprises a selection of 9 extended works that were presented at the 4th International Workshop on Numerical and Evolutionary Optimization (NEO 2016), held in September 2016 in Tlalnepantla, Mexico. The contributions of the thematic issue are summarized in the following.

In the first paper, "Solvability and Primal-Dual Partitions of the Space of Continuous Linear Semi-Infinite Optimization Problems", Abraham Bahrragán, Lidia A. Hernández, and Maxim I. Todorov propose a new classification for linear semi-infinite programming problems that generates a partition of the parameter space, called second general primal-dual partition. Further, each cell of this new partition is characterized by means of necessary and/or sufficient conditions, and non-emptiness of each of these cells is shown on several examples. Finally, various questions of stability of this partition are investigated.

Andrés Vargas and Johan Bogoya propose in their paper "A Generalization of the Averaged Hausdorff Distance" a modification of the performance indicator Δ_p that is intended to measure the approximation quality of a candidate set with respect to the Pareto front of a given multi-objective optimization problem. The new indicator, $\Delta_{p,q}$, turns out to be a proper metric whereas Δ_p is only a near-metric, while preserving some of the advantages of the original indicator.

In "Memetic Algorithm with Hungarian Matching Based Crossover and Diversity Preservation", Emmanuel Romero Ruiz and Carlos Segura consider the Graph Partitioning Problem (GPP) which is a well-known NP-hard combinatorial problem. The paper presents a newly designed hybrid algorithm that incorporates an explicit mechanism to control the diversity to improve the resources when dealing with long-term executions. The new method highly competes with the state-of-the-art, and new best-known solutions could be found in many cases.

The paper "The Gradient Subspace Approximation as Local Search Engine within Evolutionary Multi-objective Optimization Algorithms" by Sergio Alvarado, Carlos Segura, Saul Martinez, and Oliver Schütze addresses the hybridization of classical evolutionary algorithms with local search coming from mathematical programming for the effective treatment of multi-objective optimization problems. The authors argue that the use of the recently proposed gradient subspace approximation (GSA) significantly reduces the cost of the local search engine when used within population based algorithms leading to a significant increase of the overall performance.

The next papers present real-world applications of optimization algorithms. R. Ochoa-Montiel, C. Sánchez-López, V.H. Carbajal-Gómez, M.A. Carrasco-Aguilar, F.E. Mrales-López and E. Juárez-Guerra, deal with the computer vision

problem of image segmentation in the paper "Segmentación de Imágenes Microscópicas con NSGA-II". They focus on images of blood cells taken by a microscope and apply the popular multi-objective optimization algorithm NSGA-II, with competitive results on different problem formulations.

The paper "Optimization of PPF Control of a Building-like Structure for Vibration Control" presents research in the field of intelligent civil structures by J. Enríquez-Zárate, L. Trujillo, G.K. Toledo-Ramírez, Á.J. Ramos-Cirilo and C. Hernández. They optimize the control of piezoelectric actuators for a building-like structure using Positive Position Feedback control. Moreover, the control gains are optimized using a hybrid approach based on Differential Evolution and the Interior Point Algorithm, with the proposed control reducing the vibrations and lateral displacements nu around 97%.

The next paper "Comparación de Algoritmos Evolutivos Multi-Objetivo para Síntesis de Alto Nivel en Dispositivos FPGA" by Darian Reyes de Bulnes and Yazmin Maldonado addresses the problem of scheduling operations during the mapping a design on an FPGA. The authors apply several popular and recent methods, including NSGA-II, SPEA2 and NSGA-III for the optimization of covered area, delay and power consumption, and results are compared using multi-objective quality indicators, showing the strength and weaknesses of each algorithm on this important application in embedded system design.

In "Fuzzy Differential Equations as a Tool for Teaching Uncertainty in Engineering and Science" Nohe R. Cazarez-Castro, Mauricio Odreman-Vera, Selene L. Cardenas-Maciel, Hector Echavarria-Heras and Cecilia Leal-Ramirez present how uncertainty can be modeled in differential equations using fuzzy sets. They present an approach to teach such concepts in engineering and science, using as a case study the Malthusian population dynamic model. Meta-heuristic optimization has long been considered a related field to fuzzy sets and systems.

Finally, Antonio Gómez Roa, Mauricio Leonel Paz González, Andrés Calvillo Téllez, Juan Antonio Paz González, Oscar Adrián Morales Contreras and José Cruz Núñez Pérez present the paper "Análisis Dinámico Estructural de Satélite Educativo CanSat". This work provides a dynamic analysis of the educational pico-satellite CanSat. Using Finite Element and the ANSYS platform, the work presents the first 15 modal forms and natural frequencies.

The volume also contains 15 regular papers selected and reviewed by the editorial board of the journal.

Leonardo Trujillo
Yazmin Maldonado
Oliver Schuetze
Guest editors