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Editorial

Special Issue "Optimisation Models and Applications"

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Optimisation models have transcended their origins to become indispensable tools across many fields, including engineering, economics, the environment, health, systems of systems, businesses, and beyond. These models serve as guiding lights, illuminating the path toward optimal solutions. Within the optimisation realm, the following four distinct categories emerge, akin to constellations in the scientific cosmos: physics-based optimisation algorithms, swarm-based optimisation algorithms, game-based optimisation algorithms, and evolutionary-based optimisation algorithms. Over the past half-century, the optimisation domain has been a crucible where theory meets practice, generating solutions that have left indelible marks on diverse applications. In this Special Issue, our study takes us to the heart of the intricate interplay between optimisation models and their practical applications. In this realm, theory and reality merge to address fundamental scientific challenges. We earnestly invite researchers, akin to celestial navigators, to contribute their original, high-quality research papers. Let us explore the celestial expanse of optimisation and its transformative applications.

This Special Issue explores the intersection of optimisation models and real-world applications, encompassing diverse disciplines such as functional analysis, the critical point theory, bifurcation theory, set-valued analysis, calculus of variations, partial differential equations, variational and topological methods, fixed-point theory, game theory, convex analysis, matrix theory, control theory, and data mining. As a platform for researchers, it aims to bridge theoretical rigour with practical significance in addressing scientific challenges and advancing optimisation solutions across domains.

Rasouli et al. (Contribution 1) devised an adaptive sliding mode control for fractional-order chaotic systems, addressing an unknown time delay, uncertainty, and disturbances. Utilising a nonlinear fractional order PID sliding surface, stability is ensured using the Lyapunov theory and validated through MATLAB simulations. This approach extends to secure image communication, showcasing positive outcomes in correlation with NPCR, PSNR, and information entropy, even under uncertain parameters.

Ma and Xu (Contribution 2) introduced a method tackling robust multi-criteria traffic network equilibrium problems with path-capacity constraints. This study formulates an equivalent min-max optimisation problem, deploying a direct search algorithm and a smoothing optimisation approach based on a ReLU activation function variant for efficient solutions. Numerical examples highlight algorithm efficiency, particularly in small-scale traffic networks.

Giuffrè (Contribution 3) explored a nonconstant gradient-constrained problem, establishing a connection with a double obstacle problem. This study fulfils a constraint qualification condition, enabling the application of solid duality theory. It provides evidence for the existence of Lagrange multipliers, suggesting potential avenues for future research within this framework.

Swarup et al. (Contribution 4) delved into K-bonvexity/K-pseudo convexity concepts, establishing duality theorems for a K-Wolfe multi-objective second-order symmetric duality model. This work broadens mathematical perspectives, potentially contributing to

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applications in higher-order symmetric fractional programming problems and variational control problems over cones.

Gismelseed et al. (Contribution 5) employed a mathematical model to investigate factors influencing the sit-to-stand (STS) motion, formulating an optimisation problem to minimise joint torques. The model successfully predicted key STS motion characteristics, considering the motion speed, reduced joint strength, and seat height. These results align with experimental findings, providing insights into STS biomechanics for clinical investigations and daily activities related to human mobility.

Acosta-Portilla et al. (Contribution 6) introduced a methodology for solving the Monge–Kantorovich mass transfer problem, utilising Haar multiresolution analysis and wavelet transform. This approach significantly reduces computational operations, achieving efficient solutions at different resolution levels. Comparative results demonstrate consistent improvement over previous resolution levels, with exact solutions in some cases. This work offers valuable insights and suggests research opportunities for different discretisation techniques and cost function characteristics.

Rajebi et al. (Contribution 7) presented a robust license plate recognition system that is effective in adverse environmental conditions. Unlike prior approaches, this method evaluates and recognises license plates from various sources, handling environmental challenges by removing image artifacts before recognition. Utilising Hopfield's neural network for recognition reduces the execution time. It enhances accuracy compared to traditional methods, contributing significantly to automated surveillance systems.

Pourmostaghimi et al. (Contribution 8) introduced a helical gear reverse engineering methodology employing swarm-based optimisation, specifically the Grey Wolf Optimisation and Particle Swarm Optimisation. Results showcase superior performance in accuracy, convergence speed, and stability. This study suggests diverse gear applications and explores the impact of algorithm tuners on convergence speed.

Rasouli et al. (Contribution 9) proposed a robust synchronisation method for chaotic systems amid uncertainty. Combining the sliding mode control with adaptive rules ensures the convergence of unknown parameters and time delays to zero. Simulations show the robust synchronisation of uncertain, jerk-crusty systems, and the control strategy is applied successfully to secure communication.

Yaghoubi et al. (Contribution 10) present a novel approach for robust stability in polynomial fractional differential (PFD) systems using Caputo derivatives. Employing the sum of squares (SOSs) method, this research addresses stability challenges beyond linear matrix inequalities. Demonstrating robust Mittag–Leffler stability conditions, this study introduces a robust controller for PFD systems with unknown parameters and a polynomial state feedback controller for PFD-controlled systems, validated through simulations, offering innovative solutions for stability and control challenges.

Guo (Contribution 11) investigated a Mond–Weir-type robust duality for uncertain semi-infinite multi-objective fractional optimisation problems. It establishes a robust dual problem, incorporating a new subdifferential constraint qualification and a generalised convex-inclusion assumption. This study unveils robust #-quasi-weak, strong duality properties, extending previous results. These findings contribute to understanding uncertain fractional optimisation and suggest the future exploration of mixed-type robust approximate dual problems. Specific research funding sources for this work are not provided in the article.

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List of Contributions

1. Rasouli, M.; Zare, A.; Yaghoubi, H.; Alizadehsani, R. Designing a Secure Mechanism for Image Transferring System Based on Uncertain Fractional Order Chaotic Systems and NLFPID Sliding Mode Controller. *Axioms* **2023**, *12*, 828.
2. Ma, X.-X.; Xu, Y.-D. Robust Multi-Criteria Traffic Network Equilibrium Problems with Path Capacity Constraints. *Axioms* **2023**, *12*, 662.
3. Giuffrè, S. A Nonconstant Gradient Constrained Problem for Nonlinear Monotone Operators. *Axioms* **2023**, *12*, 605.
4. Swarup, C.; Kumar, R.; Dubey, R.; Fathima, D. New Class of KG-Type Symmetric Second Order Vector Optimization Problem. *Axioms* **2023**, *12*, 571.
5. Gismelseed, S.; Al-Yahmedi, A.; Zaier, R.; Ouakad, H.; Bahadur, I. Predicting Sit-to-Stand Body Adaptation Using a Simple Model. *Axioms* **2023**, *12*, 559.
6. Acosta-Portilla, J.R.; González-Flores, C.; López-Martínez, R.R.; Sánchez-Nungaray, A. Efficient Method to Solve the Monge–Kantarovich Problem Using Wavelet Analysis. *Axioms* **2023**, *12*, 555.
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8. Pourmostaghimi, V.; Heidari, F.; Khalilpourazary, S.; Qazani, M.R.C. Application of Evolutionary Optimisation Techniques in Reverse Engineering of Helical Gears: An Applied Study. *Axioms* **2023**, *12*, 252.
9. Rasouli, M.; Zare, A.; Hallaji, M.; Alizadehsani, R. The synchronisation of a class of time-delayed chaotic systems using sliding mode control based on a fractional-order nonlinear PID sliding surface and its application in secure communication. *Axioms* **2022**, *11*, 738.
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11. Guo, X. On Mond–Weir-Type Robust Duality for a Class of Uncertain Fractional Optimisation Problems. *Axioms* **2023**, *12*, 1029.