

Editorial

Advances in Process Systems Engineering: Selected Papers from China PSE Annual Meeting

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The China Process Systems Engineering (PSE) Annual Conference is a series of academic annual conferences hosted by the Process Systems Engineering Professional Committee of the Chinese Society for Systems Engineering. This conference was held in 2024 in Dalian, China, where scholars from various universities in China's PSE field conducted in-depth exchanges and discussions on the theme of "PSE Assisting the Development of New Productivity". In the past year, Chinese PSE scholars have achieved significant results in the fields of "process simulation, analysis and optimization", "process control, scheduling and planning", and "process monitoring, risk analysis and safety". During the exchanges at the conference, it was observed that AI technology is currently being integrated more effectively with process systems, and by combining it with traditional algorithms, the modeling and computation processes have become more efficient [1,2]. Additionally, greater emphasis was placed on the integration of renewable energy with traditional chemical engineering, with the proposal of carbon reduction pathways for chemical processes from a systematic perspective [3,4]. This Special Issue, "Advances in Process Systems Engineering: Selected Papers from China PSE Annual Meeting", aims to show some recent progress on process systems engineering in the Chinese PSE community. This Special Issue is available online through the following link: https://www.mdpi.com/journal/processes/special_issues/4QE87F2J2 (accessed on 7 November 2025).

This Special Issue contains the latest research in key research direction of PSE, with a total of 11 research articles and 2 review articles. Among these articles, two articles focus on the recent advances in process simulation and analysis of different processes, including electrodialysis and gas turbines. Six articles focus on the recent developments in process optimization of different systems, such as solar PV deployment in manufacturing, diesel filtration in nuclear emergency systems, organic Rankine cycles, fresh agricultural product distribution, fluid catalytic cracking processes, and cogeneration systems. There are three articles that study process control and monitoring, such as distillation process control, fault judgment of catalyst loss, and corrosion state monitoring. The methods used in these works include traditional algorithms such as genetic algorithms and fuzzy algorithms, and many works have also adopted artificial intelligence algorithms to solve PSE problems. Since artificial intelligence methods are currently a popular research direction, one review article also delves into large language models. Additionally, another review article focuses on lubricant base oils and additives. Summaries of these studies follow.

In the direction of process simulation, Chen et al. (1) focused on the heat-stable salt removal process using electrodialysis technology and systematically examined the effects of different operating conditions. An industrial case is used to validate the process conditions.



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Meng et al. (2) proposed a method which combines random forest feature selection and the chaos game optimization algorithm to predict NO_x in gas turbines; the results show that the random forest algorithm can select appropriate input variables, and the proposed method can extract the intrinsic links of the data and build a more accurate NO_x prediction model. In the direction of process optimization, Zhang et al. (3) proposed a multi-objective evaluation method for working fluids selection in an organic Rankine cycle based on data envelopment analysis. This method takes into account the thermodynamic performance of the working fluid in the organic Rankine cycle, economic aspects, and environmental considerations. A total of 62 different working fluids were evaluated in the integrated technology. Briceño (4) introduces an integrated decision-making method combining a morphological matrix and fuzzy TOPSIS to systematically select and rank optimal PV system configurations. The results demonstrate better robustness compared to existing fuzzy TOPSIS-based methods for solar PV applications. Zhang et al. (5) proposes an efficient optimization framework that integrates genetic algorithm optimization, state-space networks, and computational fluid dynamics to enhance the reliability of emergency diesel generator systems and support nuclear safety operations. Zhu et al. (6) establishes an optimization model of cold chain logistics distribution routes for fresh agricultural products. In their work, a two-objective optimization model is proposed, considering customer satisfaction maximization and comprehensive cost minimization, and then a hybrid ant colony algorithm is designed to solve the model. The results show that the method can effectively optimize the cold chain logistics distribution routes of fresh agricultural products and reduce carbon emission and distribution cost. Yang et al. [5] proposed a novel solid oxide fuel cell-based cogeneration system integrating with an organic Rankine cycle for waste heat recovery. In this work, technical–economic and parametric analyses are conducted, and a multi-objective optimization is carried out. This work provides practical reference and pragmatic guidance for the integration of SOFC-based cogeneration systems. Li et al. [6] propose an integrated framework that combines hybrid modeling and surrogate model-based optimization for the operation optimization of a fluid catalytic cracking process. This approach combines plant and simulation data to train a multi-task learning prediction model, which then serves as a surrogate for operational optimization. The results show that the model predicts product yields with an error margin of under 4.84% and the optimization can achieve a 3.67% increase in product revenues. In the direction of process control and monitoring, Wang et al. (7) propose a neural network model based on process mechanism knowledge to enhance the prediction accuracy and interpretability of the distillation processes predictive control model. The proposed model is used to conduct the dynamic modeling of a benzene–toluene distillation column. Li et al. [7] proposed a fault judgment method of catalyst loss failures with quantitative criteria via a fault tree analysis method. In this method, the relationship model between flow field signals and faults in the FCC disengager is investigated by computational fluid dynamics. The method has been applied in cases of catalyst loss in two industrial disengagers and can accurately pinpoint the main factors leading to catalyst loss faults. Wang et al. (8) proposed a new deep learning framework to synergistically integrate acoustic emission and electrochemical noise signals at the algorithmic level for corrosion monitoring. In their work, a new feature alignment loss function and a probability distribution consistency loss function are designed to facilitate more effective feature learning to improve classification performance. The experimental results demonstrate that the method achieves superior accuracy in corrosion stage classification compared to other state-of-the-art models. This approach combines plant and simulation data to train a multi-task learning prediction model, which then serves as a surrogate for operational optimization. There are two review articles in this Special Issue. Khoo et al. (9) provides a comprehensive overview of the evolution

and application of artificial intelligence and large language models in engineering, with a specific focus on chemical engineering. This review addresses the challenges and future considerations of integrating large language models into engineering workflows, emphasizing the need for domain-specific adaptations, ethical guidelines, and robust validation frameworks. Zhou et al. (10) provides a review and summary of the entire workflow for molecular simulations of lubricating oils, ranging from molecular modeling, with particular emphasis on the molecular representation of base oils, to simulation calculation methods and result analysis.

The Guest Editors would like to express their gratitude to all the authors for their high-quality manuscripts. We hope that this Special Issue will show the recent developments in the Chinese PSE community.

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List of Contributions:

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