日韓 PSE 合同シンポジウム　プログラム（案）

本シンポジウムは，日韓両国のプロセスシステム工学（PSE）分野における研究交流を促進し，学術および産業界双方の発展を目指して開催されます。

１．　日時：2025 年 12 月 19 日（金）
講演会 10:00－17:20　意見交換会（バンケット） 17:30－19:30

２．　場所：オンサイトのみ
講演会：
TKP ガーデンシティ PREMIUM 品川高輪口　Conference Room 4F
〒108-0074 東京都港区高輪 4-10-18 京急第一ビル 3～4 階
https://www.kashikaigishitsu.net/facilitys/gcp-shinagawa-takanawaguchi/access/
意見交換会（バンケット）：
講演会と同じ施設？

３．　講演会
化学工学分野では，触媒工学や分離工学などの領域で日韓合同のシンポジウムが開催され，両国の研究者が交流を重ねてきました。一方，プロセスシステム工学（PSE）分野においても多くの研究者が活動していますが，これまで日韓間で同様の交流の機会は多くありませんでした。近年，韓国の研究者から合同開催を望む声が高まり，今回，本シンポジウムの開催が実現しました。
本シンポジウムは，化学工学会システム・情報・シミュレーション部会（SIS 部会）PSE 委員会と韓国 PSE 研究者組織の共催により実施されます。日韓両国の PSE 研究者が一堂に会し，技術的・人的な交流を深めることで，学術界および産業界双方の研究をさらに活性化することを目的としています。今後もこの取り組みを継続し，両国の連携を一層強化していくことが期待されます。

＜プログラム＞
10:00 - 10:10 Opening

10:10 - 10:40 1st speaker from Korea

Decarbonization Strategies for the Chemical Industry through Integration with Multi-Energy Systems

Prof. J. Jay Liu (Pukyong National University)　e-mail: jayliu@pknu.ac.kr

Abstract: Countries worldwide are accelerating the development of full-cycle hydrogen technologies to produce and supply clean hydrogen, including SMR with CO_2 capture and renewable-based green hydrogen. Efforts are expanding to produce low-carbon chemicals such as green ammonia, green methanol, and e-fuels using clean hydrogen and captured CO_2. There is a growing need for research on multi-energy systems integrating renewable electricity, hydrogen, and natural gas through processes like fuel cells and electrolysis. Research on integrating multi-energy systems with chemical processes for industrial decarbonization is still in its early stages, with recent work highlighting achievements and future directions in process systems engineering.

10:40 - 11:10 1st speaker from Japan

Organizations and Activities in Process Systems Engineering in Japan: Current Landscape and

Perspectives

Prof. Masaru NODA (Fukuoka University)　email: mnoda@fukuoka-u.ac.jp

Abstract: This presentation provides an overview of the research organizations and major activities in the field of Process Systems Engineering (PSE) in Japan. The PSE community in Japan is represented by strong collaborations among academic institutions, industry, and professional societies, particularly under the Division of Systems, Information and Simulation Technologies of the Society of Chemical Engineers, Japan. These organizations promote research and education across diverse PSE areas, ranging from process modeling and optimization to energy systems and digital transformation. Collaborative frameworks have supported both international exchanges and practical applications in industrial practice. In addition to outlining the organizational structures and activities, the talk will briefly introduce my recent research on alarm management in process industries. This work addresses the critical challenge of reducing unnecessary or nuisance alarms in large-scale plants, with an emphasis on improving operational safety and efficiency through data-driven methods and systematic alarm analysis.

11:10 – 11:40 2nd speaker from Korea

Hydrogen: A new opportunity for PSE

Prof. Il Moon (Yonsei University)　e-mail: ilmoon@yonsei.ac.kr

Abstract: Hydrogen Energy is one of the most essential resources for human civilization. Chemical engineers have long utilized various forms of energy such as wood, coal, oil, gas, and nuclear power. However, due to the growing environmental crisis, we can no longer rely on energy sources that emit carbon dioxide. Instead, the focus has shifted toward clean and renewable sources such as solar and wind energy. The main challenge with these sources, however, lies in their intermittent and fluctuating nature. Energy Storage Systems (ESS) can temporarily store excess energy, but they are limited in capacity and duration. The most promising solution to this problem is hydrogen, which can store large amounts of energy over long periods. This emerging hydrogen-based energy system represents a significant new opportunity for Process Systems Engineering (PSE).

11:40 – 12:10 2nd speaker from Japan

Design of Membrane-Adsorption Hybrid CO2 Separation Process Using Machine Learning with Multiscale Capability

Prof. Keigo MATSUDA (Nagoya University)　email: matsuda@i.nagoya-u.ac.jp

Abstract: This study investigates a machine-learning-based approach to optimizing carbon dioxide separation processes in the context of carbon capture and storage. Hybrid processes that combine adsorption and membrane separation technologies are expected to offer high efficiency, however, their design is challenging due to the differing characteristics of each process. To address this topic, we developed a surrogate model based on neural networks, enabling multi-objective optimization of both single and hybrid systems. The results confirmed that a two-stage hybrid process can meet CCS requirements under low pressure with a low energy consumption. This method provides a practical and integrated approach that bridges material selection and process design.

12:10 – 13:50 Group photo & Lunch（弁当提供） & Networking

13:50 – 14:20 3rd speaker from Korea

A Multi-Agent LLM Framework for Explainable Reinforcement Learning

Prof. Jong Min Lee (Seoul National University)　e-mail: jongmin@snu.ac.kr

Abstract: Countries worldwide are accelerating the development of full-cycle hydrogen technologies to produce and supply clean hydrogen, including SMR with CO_2 capture and renewable-based green hydrogen. Efforts are expanding to produce low-carbon chemicals such as green ammonia, green methanol, and e-fuels using clean hydrogen and captured CO_2. There is a growing need for research on multi-energy systems integrating renewable electricity, hydrogen, and natural gas through processes like fuel cells and electrolysis. Research on integrating multi-energy systems with chemical processes for industrial decarbonization is still in its early stages, with recent work highlighting achievements and future directions in process systems engineering.

14:20 – 14:50 3rd speaker from Japan

Model-based Development of Pharmaceutical Processes

Prof. Hirokazu SUGIYAMA (The University of Tokyo)　email: sugiyama@chemsys.t.u-tokyo.ac.jp

Abstract: The speaker and his team in UTokyo have been conducting PSE research on pharmaceutical processes covering a wide range of drug types and leveraging various modeling techniques. For small molecules, flow synthesis of drug substances has been the main focus. Novel models on various reaction systems (e.g., Grignard reaction, amination, hydrogenation) have been proposed which were applied to determining design spaces and optimal conditions. For biopharmaceuticals, hybrid modeling and data-driven approaches have elucidated critical changes in cell metabolic behavior and enhanced mechanistic process understanding. For stem cell / regenerative medicine, models for cell cultivation and cryopreservation have been developed, and the model-based design space / optimal conditions have been experimentally validated. These studies illustrated the power of model-based process development with actual cases, and also the importance of interactions between experimental and simulation researchers. Being conscious of the “cost of modeling” would help effectively determine the target of model-based development.

14:50 – 15:10 Break

15:10 – 15:40 4th speaker from Korea

Carbon-negative methanol synthesis via reactive capture and conversion

Prof. Ung Lee (KIST)　e-mail: ulee@kist.re.kr

Abstract: This work reports the first realization of an amine-enabled reactive capture and conversion (RCC) strategy in which absorbed CO_2 is directly transformed into methanol, thereby avoiding the conventional energy-intensive regeneration step. Using a graph neural network–driven materials discovery platform, we pinpoint amines specifically suited to the reaction environment from a broad chemical library. The resulting reaction-integrated process achieves a record single-pass methanol yield of 56%, more than double that of existing CO_2-to-methanol pathways (<25%). Techno-economic and life-cycle evaluations reveal up to a 10% cost advantage relative to conventional processes, together with a carbon balance of –0.92 kg CO_2 per kg methanol, corresponding to nearly 67% of the theoretical maximum reduction (–1.37 kg CO_2/kg methanol).

15:40 – 16:10 4th speaker from Japan

Introduction to Intelligent Systems Optimization Laboratory - Artificial Intelligence and

Optimization for Robotics and Automation -

Prof. Tatsushi NISHI (Ritsumeikan University)　email: tnishi@fc.ritsumei.ac.jp

Abstract: We focus on intelligent optimization of industrial systems, data-driven modeling and optimization, and the integration of artificial intelligence with mathematical optimization. The objective is to develop advanced methodologies for efficient planning, scheduling, and control in complex industrial environments. By combining model-based optimization with machine learning approaches, our research enables adaptive, robust, and explainable decision-making under uncertainty. The ultimate goal is to bridge the gap between theoretical optimization and practical implementation, contributing to the advancement of intelligent, autonomous, flexible, and sustainable manufacturing and service systems.

16:10 – 16:40 5th speaker from Korea

Self-driving laboratories with artificial intelligence: An overview of process systems engineering perspective

Prof. Jonggeol Na (Ewha Womans University)　e-mail: jgna@ewha.ac.kr

Abstract: Self-Driving Laboratories (SDLs) powered by Artificial Intelligence (AI) are rapidly accelerating discovery in chemistry and materials science. We argue that key SDL technologies, including automation, optimization, and control, are fundamentally linked to the field of Process Systems Engineering (PSE)—a critical but often overlooked perspective. This presentation discusses how applying PSE principles, from hardware integration to AI-driven operating software, is crucial for achieving robust, system-wide autonomy and maximizing research efficiency.

16:40 – 17:10 5th speaker from Japan

Advancing Process Intensification: Developing Mass Transfer Models in Hydrogenation Reaction

Prof. Takafumi HORIE (Osaka Metropolitan University)　email: horie@omu.ac.jp

Abstract: Process Intensification (PI) refers to the development of innovative technologies that significantly improve process performance. While there is ongoing discussion regarding its definition, the principles and approaches of PI have been systematically summarized. One strategic approach to process intensification involves enhancing transport phenomena to address bottlenecks that limit the performance of chemical equipment. Hydrogenation reactions commonly utilize trickle-bed reactors, where the reaction occurs when hydrogen dissolves in the liquid phase of the reactants and reaches the surface of the solid catalyst. Since the mass transfer of hydrogen in the liquid phase is the rate-limiting step, it is crucial to rapidly deliver hydrogen to the catalyst surface. In this lecture, we will present our research on the Taylor-flow reactor that enhances the hydrogenation reaction process, focusing on the development of mass transfer models with an eye toward social implementation.

17:10 – 17:20　Closing

４．　意見交換会（バンケット）

17:30 – 19:30 Banquet

以上