姚　遠　教授

YUAN YAO, PROFESSOR

- 浙江大學　　學士，民國九十年
- 浙江大學　　碩士，民國九十三年
- 香港科技大學　博士，民國九十八年

- B.S.　Zhejiang University, China , 2001
- M.S.　Zhejiang University, China, 2004
- Ph.D.　Hong Kong University of Science and Technology, Hong Kong, 2009

主要研究領域

　　本實驗室的研究領域主要在於通過人工智慧方法、數據分析及電腦輔助工程解決化工製程相關問題，以期優化操作、提升品質、增強安全，協助化工產業達成智慧化生產。具體包括以下幾個方面：

▪ 製程資料分析

製程資料分析又稱製程化學計量學，是一個高度學科交叉的研究領域。其通過機器學習（包括深度學習）、多變數統計、訊號處理等資料驅動方法，解決化工製程中所面臨的問題。

- 製程監控，包括故障檢測、故障診斷、故障根因分析等
- 軟儀表技術，對不易及時量測的關鍵製程變數或產品品質變數進行預測
- 智慧化控制系統，結合資料分析、人工智慧和程序控制，優化製程操作

▪ 非破壞性檢測資料分析

透過機器學習和多變數統計方法，分析非破壞性檢測之熱成像或超音波訊號，進行高分子複料、藝術品、文化遺產或其他材料之缺陷檢測

▪ 電腦輔助工程模擬

透過電腦模擬，對加工製程、反應或產品進行分析和設計

Main Research Interests

The research in my group is presently focused on The research in my group is presently focused on the following topics:

▪ Process data analytics

Process data analytics, also called process chemometrics, is a highly interdisciplinary research field that uses data-driven methods, including artificial intelligence (machine learning), multivariate statistics, signal processing, etc., to solve problems faced by chemical industries.

- Process monitoring, including fault detection, fault diagnosis, root cause diagnosis, etc.
- Soft sensor techniques for online estimation of key performance indicators
- Intelligent process control systems integrating advanced control with artificial intelligence and process data analysis

▪ Nondestructive testing data analysis

Thermographic data analysis, ultrasonic data analysis, etc. for defect detection and structure evaluation of materials including polymer composites, artworks, cultural heritages, and so on

▪ Computer-aided engineering simulations

Utilizing computer software to simulate manufacturing processes, chemical reactions, or product performance

代表作 (Selected Publications)

- Zhen-Feng Jiang, Xi-Zhan Wei, Jia-Lin Kang, David Shan-Hill Wong, **Yuan Yao***, Yao-Chen Chuang, Shi-Shang Jang, John Di-Yi Ou (2024). Deep learning model predictive control of a high-density polyethylene reactor with a physics-guided sequence-to-sequence model with memory. *Computers & Chemical Engineering,* 189, 108790.

- Mingwei Jia, Le Zhou, Yi Liu*, Zengliang Gao, **Yuan Yao*** (2024). Global dependency graph network for soft sensing in process industry. *IEEE Sensors Journal,* 24(16), 26290-26300.

- Yi Liu, Mingwei Jia, Danya Xu, Tao Yang, **Yuan Yao*** (2024). Physics-guided graph learning soft sensor for chemical processes. Chemometrics and *Intelligent Laboratory Systems*, 249, 105131.

- Mingwei Jia, Danya Xu, Tao Yang, **Yuan Yao***, Yi Liu* (2024). Graph-guided masked autoencoder for process anomaly detection. Process Safety and *Environmental Protection*, 186, 1345-1357.

- Jian-Guo Wang, Rui Chen, Xiang-Yun Ye, Zhong-Tao Xie, **Yuan Yao***, Li-Lan Liu (2024). A hierarchical Granger causality analysis framework based on information of redundancy for root cause diagnosis of process disturbances. Computers & *Chemical Engineering*, 182, 108589.