Macau University of Science and Technology
Faculty of Innovation Engineering
Department of Engineering Science
Macao Institute of Systems Engineering

PhD. Supervisor
Tel.: +853 8897 1991
E-mail: nqwu@must.edu.mo

Academic Qualification

Ph. D. in Systems Engineering, Xi'an Jiaotong University, Xi'an, China, 1988.
M. S. in Systems Engineering, Xi'an Jiaotong University, Xi'an, China, 1985.
B. S. in Electrical Engineering, Anhui University of Technology, Huainan, China, 1982.

Teaching Area

Algorithm theory
Operations research and optimization
Automation, Electric motor and drive

Research Area

Intelligent manufacturing
Discrete event systems, and Petri net theory and applications
Production planning, scheduling and control theory, planning, scheduling

: Shenyang Institute of Automation, Chinese Academy of Sciences, Shenyang, P. R. China, Associate Professor.

: School of Industrial Engineering, Purdue University, West Lafayette, Indiana, USA, Visiting Scholar.

: Shenyang Institute of Automation, Chinese Academy of Sciences, Shenyang, P. R. China, Assistant Professor.

Research Grants

Operational Optimization and Control of Cluster Tools with Multiple Chamber Configuration in a Process Module for Wafer Fabrication, FDCT.

Self-Learning Optimal Control of City Energy Management System Based on Edge Computing, FDCT.

Optimal Scheduling and Control of Cluster Tools for Wafer Fabrication with Strict Process Constraints in Semiconductor Manufacturing, FDCT.

Maximally Permissive Supervisory Control of Resource Allocation Systems Based on Resource-Oriented Petri Nets, FDCT.

Short-Term Scheduling Optimization for Continuous Process Industry by Using Hybrid System Control Theory, FDCT.

Representative publications (Complete publication refer to my webpage)

:

[1] _____ and M. C. Zhou, , CRC Press, Taylor & Francis Group, New York, October 2009.

[2] _____ and M. C. Zhou, Resource-oriented Petri nets in deadlock prevention and avoidance, in M. C. Zhou and M. P. Fanti (Ed.), , Marcel Dekker, NY, January 2005.

[3] _____ and M. C. Zhou, A resource-oriented Petri net approach to scheduling and control of time-constrained cluster tools in semiconductor fabrication, in Z. W. Li and A. M. Al-Ahmari (Ed.), , IGI Global, New York, May, 2013.

[4] Y. Qiao, _____, and M. C. Zhou, Real-time scheduling and control of single-arm cluster tools with residency time constraint and activity time variation by using resource-oriented Petri nets, in Z. W. Li and A. M. Al-Ahmari (Ed.), , IGI Global, New York, May, 2013.

[5] _____, M. C. Zhou, F. Chu, and S. Mammar, Modeling and scheduling of crude oil operations in refinery: a hybrid timed Petri net approach, in M. Khalgui, O. Mosbahi, and A. Valentini (Ed), : , , , IGI Global, New York, May 2013.

[6] _____, M. C. Zhou, F. Chu, and S. Mammar, Modeling, Analysis, Scheduling and Control of Cluster Tools in Semiconductor Fabrication, in , Edited by M. C. Zhou, H.-X. Li and M. Weijnen, Wiley/IEEE Press, Hoboken, NJ, pp. 289-315, 2015.

:

[1] _____, Y. Qiao, Z. W. Li, A. Al-Ahmari, A. El-Tamimi, and H. Kaid, A novel control-theory-ba

approach to scheduling of high throughput screening system for enzymatic assay,
, , , early access, DOI: 10.1109/TSMC.2022.3161643.

[2] S. F. Chen, H. Fu, Y. Qiao, and _____, Route choice behavior modeling for emergency evacuat and efficiency analysis based on type-II fuzzy theory,
, vol. 23, no. 7, 6934-6949, Jul. 2022.

[3] Y. Qiao, Y. J. Lu, _____, J. Li, and B. Liu, An efficient binary integer programming model residency time-constrained cluster tools with chamber cleaning requirements,
, vol. 19, no. 3, 1757-1771, Jul. 2022.

[4] M. Ghahramani, M. C. Zhou, Y. Qiao, and _____, Spatio-temporal analysis of mobile phone netw based on self-organizing feature map, , vol. 9, no. 13, 10948-10960, J 2022.

[5] Y. F. Chen, Y. T. Li, Z. W. Li, and _____, On optimal supervisor design for discrete event syste modeled with Petri nets via constraint simplification,
, vol. 52, no. 6, 3404-3418, Jun. 2022.

[6] Q. H. Zhu, G. H. Wang, Y. Hou, and _____, Optimally scheduling dual-arm multi-cluster tools process two wafer types, , vol. 7, no. 3, 5920-5927, Jul. 2022.

[7] Z. L. Yuan, X. R. Li, D. Wu, X. J. Ban, _____, H.-N. Dai, and H. Wang, Continuous-time predict of industrial paste thickener system with differential ODE-net, /
vol. 9, no. 9, 686-698, Apr. 2022.

[8] Z. Y. Yang, _____, Y. Liang, H. Zheng, and Y. Q. Ren, SMSPL: Robust multimodal approach integrative analysis of multi-omics data, , vol. 52, no. 4, 2082-20 Apr. 2022.

[9] Y. Hou, Y. X. Zhang, _____, and Q. H. Zhu, Constrained multi-objective optimization of short-te crude oil scheduling with dual pipelines and charging tank maintenance requirement,
, vol. 588, 381-404, Jan. 2022.

[10] S. F. Chen, H. Fu, _____, Y. F. Wang, and Y. Qiao, Passenger-oriented Traffic Manageme Integrating Perimeter Control and Regional Bus Service Frequency Setting Using 3D-pMF *Transportation Research Part C*, vol. 135, Article 103529, Jan. 2022.

[11] J. Liu, _____, Y. Qiao, and Z. W. Li, Short-term traffic flow forecasting using ensemble approa based on deep belief networks, , vol. 23, no

[12] S. H. Teng, Z. F. Zheng, _____, L. K. Fei, and W. Zhang, Domain adaptation via incremer confidence samples into classification, , vol. ğ { ª

[4] J. L. Liu, S. H. Teng, L. K. Fei, W. Zhang, X. Z. Fang, Z. X. Zhang, and _____, A Novel Consensus Learning Approach to Incomplete Multi-view Clustering, , vol. 115, Article NO 107890, Jul. 2021.

[5] B. Y. Huang, H. B. Zhu, D. N. Liu, _____, Y. Qiao, and Q. Jiang, Solving last-mile logistics problem in spatiotemporal crowdsourcing via role awareness with adaptive clustering, , vol. 8, no. 3, 668-681, Jun. 2021.

[6] W. Q. Xiong, Y. Qiao, L. P. Bai, M. Ghahramani, _____, P. H. Hsieh, and B. Liu, Wafer reflectance prediction for complex etching process based on -Means clustering and neural network, , vol. 34, no. 2, 207-216, May 2021.

[7] G. H. Zhu, L. Feng, Z. W. Li, and _____, An efficient fault diagnosis approach based on integer linear programming for labeled Petri nets, , vol. 66, no. 5, 2393-2398, May 2021.

[8] Y. Wang, Y. T. Li, Z. H. Yu, _____, and Z. W. Li, Supervisory control of discrete-event systems under external attacks, , vol. 562, 398-413, Jul. 2021.

[9] Y. Qiao, S. W. Zhang, _____, M. C. Zhou, Z. W. Li, and T. Qu, Efficient approach to failure response of process module in dual-arm cluster tools with wafer residency time constraints, : , vol. 51, no. 3, 1612-1629, Mar. 2021.

[10] Z. C. Liu, _____, Y. Qiao, Z. W Li, Performance evaluation of public bus transportation by using DEA models and Shannon's entropy: an example from a company in a large city of China, / , vol. 8, no. 4, 779-795, Apr. 2021.

[11] Y. H. Pan, T. Qu, _____, H. F. Guo, M. Khalgui, and G. Q. Huang, Digital twin based real-time production logistics synchronization system in a multi-level computing architecture, , vol. 58, Part B, 246-260, Jan. 2021.

[12] Y. J. Zhou, H. R. Ren, Z. W. Li, _____, and A. M. Al-Ahmari, Anomaly Detection via a Combination Model in Time Series Data, , vol. 51, 4874-4887, Jan. 2021.

[13] X. B. Li, Z. H. Yu, Z. W. Li, and _____, Group consensus via pinning control for a class of heterogeneous multi-agent systems with input constraints, , vol. 542, 247-262, Jan. 2021.

[14] J. Liu, _____, Y. Qiao, and Z. W. Li, A scientometric review of researches on traffic forecasting in Transportation, , vol. 15, no. 1, 1-16, Jan. 2021.

[15] Y. H. Pan, _____, T. Qu, P. Z. Li, K. Zhang, and H. F. Guo, Digital-twin-driven production logistics synchronization system for vehicle routing problems with pick-up and delivery in industrial park, , vol. 34, nos. 7-8, 814-824, Feb. 2020.

[16] F. J. Yang, _____, Y. Qiao, M. C. Zhou, R. Su, and C. J. Zhang, (Digital Twin) Wafer sojourn time fluctuation analysis for time-constrained dual-arm multi-cluster tools with activity time variation, , vol. 34, nos. 7-8, 1-17, Feb. 2021.

[1] Q. L. Wei, X. Wang, X. N. Zhong, and _____, Consensus control of leader-following multi-agent systems in directed topology with heterogeneous disturbances, / , vol. 8, no. 2, 433-441, Feb. 2020.

[2] Q. H. Zhu, M. C. Zhou, Y. Qiao, _____, and Y. Hou, Multiobjective scheduling of dual-blade robotic cells in wafer fabrication, : , vol. 50, no. 12, 5015-5023, Dec. 2020.

[3] O. Karoui, Y. F. Chen, Z. W. Li, _____, and M. Khalgui, On hierarchical construction of the state space of an automated manufacturing system modeled with Petri nets, : , vol. 50, no. 10, 3613-3627, Oct. 2020.

[4] F. J. Yang, Y. Qiao, K. Z. Guo, _____, Y. T. Zhu, I. W. Simon, and R. Su, Efficient approach to scheduling of transient processes for time-constrained single-arm cluster tools with parallel chambers, : , vol. 50, no. 10, 3646-3657, Oct. 2020.

[5] Z. P. Xu, Y. Wang, _____, and X. C. Fu, Propagation dynamics of a periodic epidemic model on weighted interconnected networks, , vol. 7, no. 3, 1545-1556, Sep. 2020.

[6] F. J. Yang, X. Tang, _____, C. J. Zhang, and L. Gao, Wafer residency time analysis for time-constrained single-robot-arm cluster tools with activity time variation, , vol. 28, no. 4, 1177-1188, Jul. 2020.

[7] I. Saadaoui, Z. W. Li, and _____, Current-state opacity modeling and verification in partially observed Petri nets, , vol. 116, Article 108907, Jun. 2020.

[8] Y. Hou, _____, Z. W. Li, and Y. X. Zhang, T. Qu, and Q. H. Zhu, Many-objective optimization for scheduling of crude oil operations based on NSGA- with consideration of energy efficiency, , vol. 57, Paper NO. 100714, Sep. 2020.

[9] Q. H. Zhu, Y. Qiao, _____, and Y. Hou, Post-processing time-aware optimal scheduling of single robotic cluster tools, , vol. 7, no. 2, 597-605, Feb. 2020.

[10] F. J. Yang, _____, Y. Qiao, M. C. Zhou, R. Su, and T. Qu, Modeling and optimal cyclic scheduling of time-constrained single-robot-arm cluster tools via Petri nets and linear programming, *IEEE Transactions on Systems, Man, and Cybernetics: Systems*, vol. 50, no. 3, 871-883, Mar. 2020.

[11] G. Y. Liu, L. C. Zhang, L. Chang, A. Al-Ahmari, and _____, Robust deadlock control for automated manufacturing systems based on elementary siphon theory, , vol. 510, 165-182, 2020.

[1] Y. T. Li, L. Yin, Y. F. Chen, Z. H. Yu, and **N. Q. Wu**, Optimal Petri net supervisor synthesis for forbidden state problems using marking mask, *Information Sciences*, vol. 505, 183-197, Dec. 2019.

[2] Y. Qiao, S. W. Zhang, _____, X. Wang, Z. W. Li, M. C. Zhou, and T. Qu, Data-driven approach to optimal control of ACC systems and layout design in large rooms with thermal comfort consideration by using PSO, , vol. 236, Article 117578, Nov. 2019.

[3] X. Y. Cong, A. R. Wang, Y. F. Chen, _____, T. Qu, M. Khalgui, and Z. W. Li, Most permissive liveness-enforcing Petri net supervisors for discrete event systems via linear monitors, , vol. 92, 145-154, Sep. 2019.

[4] G. Y. Liu, P. Li, Z. W. Li, and _____, Robust deadlock control for automated manufacturing systems with unreliable resources based on Petri net reachability graphs, : , vol. 49, no. 7, 1371-1385, Jul. 2019.

[5] H. F. Chen, _____, Z. W. Li, and T. Qu, On a maximally permissive deadlock prevention policy for automated manufacturing systems! ! Œ !

[7] C. F. Zhong, W. L. He, Z. W. Li, _____, and T. Qu, Deadlock analysis and control using Petri net decomposition techniques, , vol. 482, 440-452, May 2019.

[8] J. Wang, Y. F. Zhang, Y. Liu, and _____, Multiagent and bargaining-game-based real-time scheduling for Internet of Things-enabled flexible job shop, , vol. 6, no. 2, 2518-2531, Apr. 2019.

[9] Q. H. Zhu, Y. Qiao, and _____, Optimal integrated schedule of entire process of dual-blade multi-cluster tools from start-up to close-down, , vol. 6, no. 2, 553-565, Mar. 2019.

[10] G. H. Zhu, Z. W. Li, _____ and A. Al-Ahmari, Fault identification of discrete event systems modeled by Petri nets with unobservable transitions, : , vol. 49, no. 2, 333-345, Feb. 2019.

[1] C. Gu, X. Wang, Z. W. Li, and _____, Supervisory control of state-tree structures with partial observation, , vol. 465, 523-544, Oct. 2018.

[2] Z. Y. Jiang, Z. W. Li, _____, and M. C. Zhou, A Petri net approach to fault diagnosis and restoration for power transmission systems to avoid the output interruption of substations, , Vol. 12, no. 3, 2566-2579, Sep. 2018.

[3] G. H. Zhu, Z. W. Li, and _____, Model-based fault identification of discrete event systems using partially observed Petri nets, , vol. 96, 201-212, Jul. 2018.

[4] F. J. Yang, _____, K. Z. Gao, C. J. Zhang, Y. T. Zhou, R. Su, and Y. Qiao, Efficient approach to cyclic scheduling of single-arm cluster tools with chamber cleaning operations and wafer residency time constraint, , vol. 31, no. 2, 196-205, May 2018.

[5] C. R. Pan, M. C. Zhou, Y. Qiao, and _____, Scheduling cluster tools in semiconductor manufacturing: recent advances and challenges, , vol. 15, no. 2, 586-601, Apr. 2018.

[6] Y. Qiao, _____, F. J. Yang, M. C. Zhou, and Q. H. Zhu, Wafer sojourn time fluctuation analysis of time-constrained dual-arm cluster tools with wafer revisiting and activity time variation, *IEEE Transactions on Systems, Man, and Cybernetics*: *Systems*, vol. 48, no. 4, 622-636, Apr. 2018.

[7] Q. H. Zhu, M. C. Zhou, Y. Qiao, and _____, Petri net modeling and scheduling of a close-down process for time-constrained single-arm cluster tools, *IEEE Transactions on Systems, Man, and Cybernetics*: *Systems*, vol. 48, no. 3, 389-400, Mar. 2018.

[8] F. J. Yang, _____, Y. Qiao, and M. C. Zhou, Optimal one-wafer cyclic scheduling of hybrid multirobot cluster tools with tree topology, *IEEE Transactions on Systems, Man, and Cybernetics*: *Systems*, vol. 48, no. 2, 289-298, Feb. 2018.

[9] H. M. Zhang, L. Feng, _____, and Z. W. Li, Integration of learning-based testing and supervisory control for requirements conformance of black-box reactive systems, , vol. 15, no. 1, 2-15, Jan. 2018.

[10] X. Wang, Y. Qiao, _____, Z. W. Li, and T. Qu, On optimization of thermal sensation satisfaction rate and energy efficiency of public rooms: A case Study, , vol. 176, 990-998, Jan. 2018.

[11] F. J. Yang, _____, Y. Qiao, and M. C. Zhou, Polynomial approach to optimal one-wafer cyclic scheduling of treelike hybrid multi-cluster tools via Petri nets, , vol. 5, no. 1, 270-280, Jan. 2018.

[12] S. H. Teng, _____, H. B. Zhu, L. Y. Teng, and W. Zhang, SVM–DT–Based adaptive and collaborative intrusion detection, , vol. 5, no. 1, 108-118, Jan. 2018.

[1] M. Liu, S. G. Wang, M. C. Zhou, D. Liu, A. Al-Ahmari, T. Qu, _____, and Z. W. Li, Deadlock and liveness characterization for a class of generalized Petri nets, , vol. 420, 403-416, Dec. 2017.

[2] F. J. Yang, _____, Y. Qiao, and M. C. Zhou, Optimal one-wafer cyclic scheduling of time-constrained hybrid multicluster tools via Petri nets, , , : , vol. 47, no. 11, 2920-2932, Nov. 2017.

[3] _____, Z. W. Li, and T. Qu, Energy efficiency optimization in scheduling crude oil operations of refinery based on linear programming, , vol. 166, 49-57, Nov. 2017.

[4] S. W. Zhang, _____, Z. W. Li, T. Qu, and C. D. Li, Petri net-based approach to short-term scheduling of crude oil operations with less tank requirement, , vol. 417, 247-261, Nov. 2017.

[5] Y. Qiao, M. C. Zhou, _____, and Q. H. Zhu, Scheduling and control of startup process for single-arm cluster tools with residency time constraints, , vol. 25, no. 4, pp. 1243-1256, Jul. 2017.

[6] Q. H. Zhu, M. C. Zhou, Y. Qiao, and _____, Scheduling transient processes for time-constrained single-arm robotic multi-cluster tools, , vol. 30, no. 3, 261-269, Aug. 2017.

[7] Y. Hou, _____, M. C. Zhou, and Z. W. Li, Pareto-optimization for scheduling of crude oil operations in refinery via genetic algorithm, , , : , vol. 47, no. 3, 517-530, Mar. 2017.

[8] F. J. Yang, _____, Y. Qiao, M. C. Zhou, and Z. W. Li, Scheduling of single-arm cluster tools for an atomic layer deposition process with residency time constraints, , , : , vol. 47, no. 3, 502-516, Mar. 2017.

[9] Y. F. Chen, Z. W. Li, A. Al-Ahmari, N. Q. Wu, and T. Qu, Deadlock recovery for flexible manufacturing systems modeled with petri nets, , vol. 381, pp. 290–303, Mar. 2017.

[10] Y. F. Chen, Z. W. Li, K. Barkaoui, _____, M. C. Zhou, Compact supervisory control of discrete event systems by Petri nets with data inhibitor arcs, , , : , vol. 47, no. 2, pp. 364–379, Feb. 2017.

2021 Hsue-shen Tsien Paper Award for the paper “Polynomial Approach to Optimal One-wafer Cyclic Scheduling of Treelike Hybrid Multi-Cluster Tools via Petri Nets, / , vol. 5, no. 1, pp. 270-280, Jan. 2018”, Nov. 2021.

Third Class Award of Natural Science, Macau, 2018.

Third Class Award of Technological Invention, Macau, 2016.

Highly cited researchers in Thomson Reuters’ Highly Cited Researchers 2012.

First Class Award of Natural Science of Guangdong Province, China, 2010.

Who's Who in Science and Engineering (Marquis *Who's* Who), 7th Edition (2003-2004).

Who's Who in Science and Engineering (Marquis *Who's* Who), 8th Edition (2005-2006).

Who's Who in the World (Marquis *Who's* Who), 8th Edition (2007-2008).

2011 QSI Best Application Paper Award Finalist, for the paper "Modeling and Analysis of Dual-Arm Cluster Tools for Wafer Fabrication with Revisiting," by Y. Qiao, N. Wu, and M. C. Zhou, , Trieste, Italy, August 24 - 27, 2011.

Best student paper award, for the paper “Real-time control policy for single-arm cluster tools with residency time constraints and activity time variation by using Petri net,” By Y. Qiao, N. Q. Wu, and M. C. Zhou, 2012 , Beijing, China, April 11-13, 2012.

2016 Best Conference Paper Award Finalist, for the paper “Optimizing close-down processes of single-robot cluster tools via linear programming,” by Y. Qiao, M. C. Zhou, N. Q. Wu, Q. H. Zhu, and Z. W. Li, , Fort Worth, TX USA, August 21-24, 2016.

Associate Editor: Information Sciences, 2017-

Associate Editor: IEEE/CAA Journal of Automatica Sinica, 2015-2018.

Associate Editor: IEEE Transactions on Systems, Man, & Cybernetics, Part C, 2007-2012.

Associate Editor: IEEE Transactions on Automation Science and Engineering, 2009-2012.

Editor in Chief: Industrial Engineering Journal, 2009-2014.

Associate Editor: IEEE Transactions on Systems, Man, & Cybernetics: Systems, 2013-2016.