INDIN 2023 Special Session Proposal

Title of the Proposal: Fault diagnosis and attack detection for industrial cyber-physical systems

-The name, a photo, a very short bio, contact details and IEEE IES membership of the Session Organizer:

Organizer 1

 Dr. Yuchen Jiang *received the B.E. degree in automation and the Ph.D. degree in control science and engineering from Harbin Institute of Technology, Harbin, China, in 2016 and 2021, respectively. He is currently an assistant professor with the School of Astronautics, Harbin Institute of Technology. During 2019-2020, Dr. Jiang was a visiting PhD researcher with the Lehrstuhl für Steuerungs- und Regelungstechnik (Chair of Automatic Control Engineering), Technical University of Munich, Germany. He has published over 20 peer-reviewed journal papers and 20 more at international conferences. His research interests include data-driven safety and security monitoring, fault diagnosis, fault-tolerant control, and the applications to complex systems such as industrial cyber-physical systems. His homepage is at* http://homepage.hit.edu.cn/jiangyuchen
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Organizer 2

 Dr. Kuan Li *received the B.E. degree in electrical engineering and automation from Harbin Engineering University, Harbin, China, in 2016, the Ph.D. degree in control science and engineering from Harbin Institute of Technology, Harbin, China, in 2021. He is currently an engineer at Shanghai Aerospace Control Technology Institute, Shanghai, China. In 2020, Dr. Li was a visiting PhD researcher at the Department of Electronics Engineering, University of Seville, Spain. He has published over 20 peer-reviewed papers at international journals and conferences. His research interests include system identification, signal processing, process monitoring, data-driven fault diagnosis, fault-tolerant control, permanent magnet synchronous motor control and their applications in the industrial systems.*
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Organizer 3

Prof. Hao Luo *received the B.E. degree in electrical engineering from Xi'an Jiaotong University, Xi'an, China, in 2007, and the M.Sc. and Ph.D. degrees in electrical engineering and information technology from the University of Duisburg-Essen, Duisburg, Germany, in 2012 and 2016, respectively. He is currently a Full Professor with the School of Astronautics, Harbin Institute of Technology, Harbin, China. His research interests include model-based and data-driven fault diagnosis, fault-tolerant systems, and their plug-and-play application on industrial systems. Prof. Luo is now the Chair of IEEE IES Technical Committee of "Data-Driven Control and Monitoring". His homepage is at* http://homepage.hit.edu.cn/haoluo

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Organizer 4

Prof. Reinaldo M. Palhares *received the Ph.D. degree in electrical engineering from the UNICAMP, Campinas, Brazil, in 1998. He is currently a Full Professor with the Department of Electronics Engineering, Federal University of Minas Gerais, Belo Horizonte, Brazil. His main research interests include robust control, fault detection, diagnosis and prognosis, and artificial intelligence. Prof. Palhares has been serving as an Associate Editor for the IEEE TRANSACTIONS ON FUZZY SYSTEMS, IEEE TRANSACTIONS ON INDUSTRIAL ELECTRONICS, and Sensors. He had also served as a Guest Editor for the IEEE TRANSACTIONS ON INDUSTRIAL ELECTRONICS— Special Section on "Artificial Intelligence in Industrial Systems," the IEEE/ASME TRANSACTIONS ON MECHATRONICS Focused Section on "Real-time Monitoring, Diagnosis, and Prognosis and Health Management for Electric Vehicles" and the Focused Section on "Health Monitoring, Management and Control of Complex Mechatronic System," and also the Journal of The Franklin Institute—Special Section on "Recent Advances on Control and Diagnosis via Process Measurements." He is a member of the Conference Board of the IFAC for the term 2020–2023, and currently a member of the IFAC TC 3.2 "Computational Intelligence in Control"; IFAC TC 6.4 "SAFEPROCESS"; IEEE-IES TC on Data-Driven Control and Monitoring (TC-DDCM); and IEEE TC on Robust and Complex Systems. His homepage is at* http://www.cpdee.ufmg.br/~palhares/

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Prof. Shen Yin *received the M.Sc. and Ph.D. (Dr.-Ing.) degree from the University of Duisburg-Essen, Germany. He is currently DNV-GL Professor with the Department of Mechanical and Industrial*

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-Technical Outline of the Session and Topics:

Outline of the Session

Industrial cyber-physical systems (ICPS) are enabling real-time perception, dynamic control, and information services for complex industrial processes and scenarios. The increasing demands on safe and reliable operation, as well as scalable design of large-scale industrial plants against cyberattacks, have facilitated the advancement of novel approaches to anomaly detection and diagnosis from multiple disciplines (e.g., communication, control, computer science). Among the many open scientific questions towards improved safety of ICPS, this Special Session starts from a systems and control perspective, and is especially interested in novel fault diagnosis (FD) and attack detection system design schemes, algorithmic approaches, solutions, and real-world application examples from research groups worldwide. We welcome both academic researchers and industrial practitioners to submit their new ideas, findings, approaches, frameworks, tools, or case studies to this Special Session. This SS also provides a forum to discuss the vital issues, challenges and possible future trends which are closely related to safety designs against faults and attacks in ICPS.

Topics of the Session include, but are not limited to:

- *Data-driven residual generator design*
- *Multivariate statistical analysis-based and subspace-aided approaches*
- *Plant-wide process monitoring and fault diagnosis*
- *Monitoring/control performance degradation evaluation*
- *Performance-supervised and performance-oriented FD approaches*
- *Explainable artificial intelligence (XAI) for FD of complex industrial systems*
- *Security issues in data-driven fault diagnosis*
- *Detection of deception/concealed attacks*
- *Detectability of attacks in industrial cyber-physical systems*
- *Online and real-time implementation with practical applications*
- *Other topics that are closely related to the scope of the SS*

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-IEEE IES Technical Committee Sponsoring the Special Session (if any):
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-Other: None