Special Session XI

Special Session Basic Information:

专栏题目 Session Title	中文：机理知识引导的机械设备智能诊断 英文：Mechanism Knowledge-Guided Intelligent Diagnosis of Mechanical Equipment

专栏介绍和征稿主题
Introduction and topics

中文：随着工业设备向大型化、复杂化、智能化方向发展，其关键机械部件的健康管理面临严峻挑战。传统纯数据驱动的智能诊断方法虽取得了显著进展，但仍普遍存在对数据质量高度依赖、可解释性差、在变工况与小样本场景下泛化能力不足等问题。本专题聚焦于将机械系统深层的物理机理（如动力学建模、失效模式、故障演化规律）与先进人工智能技术（如深度学习、知识图谱、大模型）进行深度融合，旨在突破现有智能诊断方法的瓶颈，构建兼具高精度、高可解释性与强鲁棒性的新型诊断范式。征稿主题包括但不限于：1. 机理与数据融合驱动的故障建模与诊断方法；2. 可解释的智能诊断模型与物理信息神经网络；3. 小样本、不均衡及变工况下的机理知识引导诊断；4. 基于数字孪生与机理模型的设备健康状态预测；5. 动力学机理与知识图谱协同的智能推理与诊断决策；6. 关键机械部件（轴承、齿轮、转子等）的跨工况与跨设备诊断应用；7. 基于机理知识引导的大模型智能诊断算法及应用。

英文：As industrial equipment continues to evolve towards larger sizes, greater complexity, and higher levels of intelligence, the health management of its key mechanical components faces significant challenges. Although traditional data-driven intelligent diagnosis methods have made remarkable progress, they still commonly suffer from issues such as high dependence on data quality, poor interpretability, and insufficient generalization capabilities in variable operating conditions and small sample scenarios. This special topic focuses on integrating the deep physical mechanisms of mechanical systems (such as dynamic modeling, failure modes, and fault evolution patterns) with advanced artificial intelligence technologies (such as deep learning, knowledge graphs, and large models) to achieve a breakthrough in existing intelligent diagnosis methods and to construct a new diagnostic paradigm with high accuracy, high interpretability, and strong robustness. The topic of the call for papers includes, but is not limited to: 1. Mechanism and data fusion-driven fault modeling and diagnosis methods; 2. Explainable intelligent diagnosis models and physical information neural networks; 3. Mechanism knowledge-guided diagnosis in small sample, imbalanced, and variable operating condition scenarios; 4. Equipment health status prediction based on digital twins and mechanism models; 5. Intelligent reasoning and diagnosis decision-making based on the synergy of dynamic mechanisms and knowledge graphs; 6. Cross-condition and cross-device diagnostic applications for key mechanical components (bearings, gears, rotors, etc.); 7. Intelligent diagnosis algorithms and applications based on mechanism knowledge guidance and large models.

Special Session Chair(s):

姓名 Name	蒋飞 / Fei Jiang
称谓 Prefix	副教授 / Assoc. Prof.
部门 Department	机械工程学院 / School of Mechanical Engineering
单位 Organization	东莞理工学院 / Dongguan University of Technology
城市/地区 City/Region	东莞 / Dongguan

Organizer's Brief Biography

中文：蒋飞，东莞理工学院机械工程学院准聘副教授，东莞市三类特色人才、广东省机械工程学会会员、中国振动工程学会会员、《动力学、监测与诊断学报》(Journal of Dynamics, Monitoring and Diagnostics, JDMD)青年编委。围绕基于深度学习的智能诊断、机器视觉缺陷检测、机械系统动力学与信号处理方法等领域进行了深入研究；主持国家自然科学基金青年项目 1 项，广东省区域联合基金-青年基金/地区培育项目各 1 项，参与国家重点研发计划、国家自然科学基金、广东省自然科学基金等课题研究。申请人共发表论文 40 余篇，其中以第一/通讯作者在本领域高水平期刊发表 SCI 论文 20 余篇，ESI 高被引论文 1 篇；授权和申请发明专利 10 余件。

英文：Fei Jiang is a tenure-track associate professor at the School of Mechanical Engineering, Dongguan University of Technology. He is third-category characteristic talent of Dongguan City, member of the Guangdong Mechanical Engineering Society, member of the Chinese Vibration Engineering Society, and a young editor of the Journal of Dynamics, Monitoring and Diagnostics (JDMD). He has conducted in-depth research in areas such as intelligent diagnosis based on deep learning, machine vision defect detection, and mechanical system dynamics and signal processing methods. He has been responsible for one National Natural Science Foundation of China Youth Project, one Guangdong Regional Joint Fund - Youth Fund/Regional Cultivation Project, and one project from the National Key Research and Development Program, National Natural Science Foundation of China, and Guangdong Natural Science Foundation. He has published over 40 papers, among which more than 20 papers were published in high-level journals in this field as the first or corresponding author, and 1 ESI highly cited paper was published. He has also obtained and applied over 10 patents.

姓名 Name	潘作舟 / Zuozhou Pan
称谓 Prefix	副教授 / Assoc. Prof.
部门 Department	计量测试与仪器学院 / College of Metrology Measurement and Instrument
单位 Organization	中国计量大学 / China Jiliang University
城市/地区 City/Region	杭州 / Hangzhou

Organizer's Brief Biography

中文：潘作舟，中国仪器仪表学会青年培育人才，浙江省青年托举人才。担任中国机械工程学会、中国仪器仪表等学会青年委员 4 项（包含二级学会）。在 Mechanical Systems and Signal Processing、ISA Transactions、Measurement 等国际知名期刊发表论文共计 31 篇（TOP 期刊 8 篇（独立一作），SCI 一区 4 篇，ESI 高被引论文 2 篇（单篇他引量超 200 次），总他引量 950 次，H-Index 指数 13）。先后获 2021 年河北省科技进步三等奖、2022 年中国仪器仪表学会科技进步二等奖。目前，主持 2026 年国家自然科学基金青年项目、2025 年浙江省青年人才托举项目、2025 年浙江省自然科学基金青年项目。

英文：Pan Zuozhou is a recipient of the Young Talent Cultivation Programme of the Chinese Society of Instrumentation and Measurement, and a Zhejiang Provincial Young Talent Support Programme awardee. He has published a total of 31 papers in internationally renowned journals such as Mechanical Systems and Signal Processing, ISA Transactions and Measurement (including 8 papers in TOP journals, 4 papers in SCI Q1 journals, and 2 ESI highly cited papers (each with over 200 citations), total citations: 950, H-index: 13). He has been awarded the Third Prize for Scientific and Technological Progress in Hebei Province in 2021 and the Second Prize for Scientific and Technological Progress from the Chinese Society of Instrumentation and Measuremen in 2022. Currently, he is leading the 2026 National Natural Science Foundation of China Young Scientist Project, the 2025 Zhejiang Province Young Talent Support Project, and the 2025 National Natural Science Foundation of Zhejiang Province Youth Science Project.

姓名 Name	杨翼 / Yi Yang
称谓 Prefix	副教授 / Assoc. Prof.
部门 Department	智能科学学院 / College of Intelligence Science and Technology
单位 Organization	国防科技大学 / National University of Defense Technology

	城市/地区 **City/Region**	长沙 / Changsha

Organizer's Brief Biography

中文：杨翼，国防科技大学智能科学学院副教授，主要面向装备状态感知与敏捷保障重大需求，从事装备动力传动系统动力学与健康管理研究，入选第十届中国科协青年人才托举工程、国防科技大学高层次创新人才支持计划，主持了国家自然科学基金面上项目、青年基金、装备预研课题、国防基础科研计划、装备综合研究、湖南省面上项目、国家重点实验室基金等项目/课题，在 MSSP、IJMS、JSV 等知名期刊和会议发表论文 80 余篇，获得多国院士和学会 Fellow 正面评价和引用，H 指数 17。研究成果应用于多型装备动力传动系统的振动分析与监测诊断，为相关重大任务的装备保障提供了技术支撑。

英文：Yang Yi, associate professor of National University of Defense Technology, is mainly engaged in the research on dynamics and health management of equipment power transmission system for the major needs of equipment status perception and agile support. He was selected into the 10th China Association for Science and Technology Youth Talent Promotion Project and the National University of Defense Technology High level Innovative Talent Support Plan. He presided over the general projects of the National Natural Science Foundation, the Youth Fund, the equipment pre research project, the national defense basic scientific research plan, the equipment comprehensive research, the general projects of Hunan Province, the State Key Laboratory Fund and other projects/topics. He has published more than 80 papers in well-known journals and conferences such as MSSP, IJMS, JSV, and won positive comments and quotations from fellow academicians and societies in many countries, with an H index of 17. The research results have been applied to the vibration analysis and monitoring diagnosis of power transmission systems for various types of equipment, providing technical support for equipment support in related major tasks.