Special Session VIX

Special Session Basic Information:

专栏题目 Session Title	中文：复杂机电系统寿命预测与智能运维大模型 英文：Remaining Useful Life Prediction and Intelligent Maintenance Large Models of Complex Electromechanical Systems

专栏介绍和征稿主题
Introduction and topics

中文：风电装备、工业机器人等复杂机电系统在长周期服役工况下，不可避免地出现性能衰退与结构损伤退化问题，严重制约装备运行安全性与服役可靠性。预测性维护能够兼顾复杂机电系统运行安全性与运维经济性双重需求，已成为装备运行维护领域的研究热点与发展趋势。剩余寿命预测与智能运维决策是预测性维护体系的核心关键技术。近年来，通用大模型技术迅猛发展，为复杂机电系统寿命预测与智能运维技术革新注入了全新动能。如何将大模型理论方法与工业装备寿命演化机理、运维实际需求深度融合，构建适配风电、机器人等典型工业场景的垂直领域智能运维大模型，已成为学术界与工业界共同聚焦的前沿方向。

本专栏旨在为从事该领域基础研究、技术创新与工程应用的专家学者及科研人员搭建高水平学术交流与成果共享平台，汇聚最新研究成果与技术进展，促进多学科交叉融合，推动复杂机电系统智能运维大模型理论与应用技术的创新发展与产业化落地。征稿主题包括但不限于以下内容：

- 面向复杂机电系统的运维专用大模型架构设计与优化
- 基于大模型的机电装备故障诊断、溯源与异常识别方法
- 融合物理机理与大模型的机电系统剩余寿命预测理论与方法
- 风电装备/机器人全生命周期退化数据集构建与大模型训练范式
- 大模型驱动的复杂机电系统智能运维决策与调度优化
- 小样本、弱标签工况下工业运维大模型泛化与自适应迁移
- 智能运维大模型边缘部署、轻量化算法及工程应用验证

英文：Complex electromechanical systems such as wind power equipment and industrial robots inevitably suffer from performance recession and structural damage degradation under long-term service conditions, which seriously restrict operational safety and service reliability of equipment. Predictive maintenance can balance the dual demands of operational safety and maintenance economy for complex electromechanical systems, and has become a research hotspot and development trend in the field of equipment operation and maintenance. Remaining useful life prediction and intelligent operation & maintenance decision-making serve as the core technologies of the predictive maintenance system. In recent years, the rapid advancement of general large model technologies has injected new impetus into the technological innovation of remaining useful life prediction and intelligent maintenance for complex electromechanical systems. It has become a cutting-edge research focus in both academia and industry to deeply integrate large model theories and methodologies with the life evolution mechanism of industrial equipment as well as practical operation and maintenance requirements, and to construct domain-specific intelligent maintenance large models adapted to typical industrial scenarios such as wind power and robots.

This special issue aims to establish a high-level platform for academic exchange and achievement sharing for experts, scholars and researchers engaged in fundamental research, technological innovation and engineering applications in this field. It gathers the latest research findings and technical progress, promotes interdisciplinary integration, and facilitates the theoretical innovation, technological development and industrial implementation of intelligent maintenance large models for complex electromechanical systems. Topics of interest include, but are not limited to, the following:

- Architecture design and optimization of dedicated large models for operation and maintenance of complex electromechanical systems
- Large model-based fault diagnosis, traceability and anomaly identification methods for electromechanical equipment

- Remaining useful life prediction theories and methods for electromechanical systems integrating physical mechanisms and large models
- Full-lifecycle degradation dataset construction and large model training paradigm for wind power equipm ent and robots
- Large model-driven intelligent maintenance decision-making and scheduling optimization for complex elec tromechanical systems
- Generalization capability and adaptive transfer learning of industrial maintenance large models under sm all-sample and weak-label scenarios
- Lightweight design, edge deployment and engineering application verification of intelligent operation & maintenance large models

Special Session Chair(s):

姓名 Name	Naipeng Li
称谓 Prefix	Professor
部门 Department	Mechanical Engineering School
单位 Organization	Xi'an Jiaotong University
城市/地区 City/Region	Xi'an/Shaanxi

Organizer's Brief Biography

中文：李乃鹏，教授、博导，国家级青年人才。面向风电机组、机器人、太空探测装置等复杂机电装备，开展状态自主感知、寿命预测、智能控制、运维大模型等方面研究。主持国家自然科学基金青 B/面上/青 C、企业合作项目等 10 余项。担任《Measurement》、《Science China Technological Sciences》等多个期刊青年编委。出版英文专著 1 部，发表高质量学术论文 40 余篇，WOS 总他引 5000 余次，参与制定国家标准 4 项，授权国家发明专利 30 余项，专利权转让 6 件。研究成果在风电装备、工业机器人、重卡车辆等得到应用。获陕西省自然科学一等奖（排 2）、陕西高等学校科学技术一等奖 2 项（分别排 1、2）、中国自动化学会自然科学一等奖（排 4）、教育部技术发明一等奖（排 5）等，入选 Clarivate 全球高被引科学家、Elsevier 全球前 2%顶尖科学家榜单。

学校的个人主页：https://faculty.xjtu.edu.cn/naipeng-li/

英文：Naipeng Li, Professor, PhD Supervisor, National Young Talent. His research focuses on autonomous condition perception, remaining useful life prediction, intelligent control, and maintenance large models for complex electromechanical equipment, including wind turbines, robots, and space exploration devices. He has led more than 10 research projects, including National Natural Science Foundation of China and enterprise cooperation projects. He serves as a Youth Editorial Board Member for several journals, including Measurement and Science China Technological Sciences. He has authored 1 English monograph, published more than 40 high-quality academic papers with over 5,000 total WOS citations, participated in formulating 4 national standards, been granted more than 30 national invention patents, and completed 6 patent transfers. His research achievements have been applied to wind power equipment, industrial robots, heavy-duty trucks, etc. He has received the First Prize of Natural Science Award of Shaanxi Province (2nd), two First Prizes of Science and Technology Award of Universities in Shaanxi (1st, 2nd), First Prize of Natural Science Award of Chinese Association of Automation (4th), and First Prize of Technological Invention Award of Ministry of Education (5th). He was selected as a Clarivate Highly Cited Researcher and included in the Elsevier World's Top 2% Scientists List.

Homepage: https://faculty.xjtu.edu.cn/naipeng-li/

姓名 **Name**	Lechang Yang
称谓 **Prefix**	Professor
部门 **Department**	School of Mechanical Engineering
单位 **Organization**	University of Science and Technology Beijing
城市/地区 **City/Region**	Beijing

Organizer's Brief Biography

中文：杨乐昌，教授，博士生导师，人社部“香江学者”，长期从事质量可靠性相关研究。担任中国运筹学会可靠性分会委员，中国系统工程学会系统可靠性工程专业委员会委员，中国机械工程学会可靠性工程分会委员，中国航空学会可靠性工程分会青年委员，中国现场统计研究会可靠性工程分会常务理事，ASCE-ASME Journal of Risk and Uncertainty in Engineering Systems, Part A: Civil Engineering & Part B: Mechanical Engineering 编委， Reliability Engineering & System Safety、Measurement Science and Technology、Axioms 等期刊客座编辑。主持国家自然科学基金、广东省自然科学基金、航空科学基金等科研项目十余项，发表高水平学术论文 50 余篇，受邀在 ICRMS、DigiTwin 等国际会议做特邀报告，担任 ESREL、PHM、QR2MSE、ICRSE、ICRMS、ISRERM、SRSE 等国际学术会议分会场主席或学术委员会委员，获国际学术奖 2 项，国际会议最佳论文奖 2 项，一级学会社会力量奖 2 项。

英文：I am a Professor of Reliability Engineering at the University of Science and Technology Beijing (USTB). I hold a Ph.D. in system engineering and a bachelor's degree in aircraft design, both obtained from Beihang University, China. Given a multidisciplinary background, my research fields include mechanical engineering, system engineering, and industrial engineering, but all are centered around reliability and risk problems. I have led many research projects (as PI) and received competitive funding, such as the National Natural Science Foundation of China (NSFC) granted project, the Basic and Applied Basic Research Foundation of China (BABRFC) granted projects, and the Aeronautical Science Foundation of China (ASFC) granted project. I have published more than 50 peer-reviewed journal/conference papers and earned over 1100 citations. Such research results are appreciated by academic communities (Best Paper Award in international academic conferences) and are recognized by engineering practitioners (First Prize of China Machinery Industry Science and Technology Award).

姓名 **Name**	Chengjin Qin
称谓 **Prefix**	Associate Professor
部门 **Department**	School of Mechanical Engineering
单位 **Organization**	Shanghai Jiao Tong University
城市/地区 **City/Region**	Shanghai

Organizer's Brief Biography

中文：覃程锦，上海交通大学副教授、博导，上海市东方英才计划、上海市青年科技启明星获得者。主要从事高端装备智能运维、机器人学与智能控制等方面研究，主持国家自然科学基金面上和青年项目、国家科技重大专项课题等多个国家省部级项目。在 IEEE TII、MSSP、中国科学等国内外期刊发表一作/通讯 SCI 论文 75 篇（48 篇中科院 1 区 top，17 篇 ESI 高被引），SCI 引用超 3700 次（谷歌学术被引近 5000 次），H 指数 40；授权发明专利 27 项。获中国机械工业科学技术特等奖、神农中华农业科技奖一等奖等 3 项省部级奖。指导博士生入选 2024 年中国科协青年人才托举工程博士生专项计划（首届）。担任 Scientific Reports 期刊编委，IJHM 和 JDMD 期刊青年编委、SCI 期刊特邀客座主编，以及 Advanced Science 等 30 多个国内外国际期刊审稿人。入选 Elsevier 全球前 2%顶尖科学家榜单。学校的个人主页：https://me.sjtu.edu.cn/teacher_directory1/qinchengjin.html.

英文：Qin Chengjin is an associate professor and doctoral supervisor at Shanghai Jiao Tong University, and He was selected for the Shanghai "Oriental Talent" Program and the Shanghai Rising-Star of Science and Technology Program. His research focus on prognostics and health management (PHM) for high-end equipment, robotics and intelligent control. He has led several national and provincial projects, including the General Program and Young Scientists Fund of the National Natural Science Foundation of China, National Science and Technology Major Projects. He has published 75 first-author or corresponding-author SCI papers (48 ranked in CAS Q1 Top, 17 ESI Highly Cited) in prestigious journals such as IEEE TII and MSSP, with over 3,700 citations in Web of Science (nearly 5,000 in Google Scholar) and an H-index of 40. He owns 27 authorized invention patents and has received 3 provincial and ministerial-level technology awards, including the Special Prize of the China Machinery Industry Science and Technology Award. He supervised a doctoral student who was selected for the 2024 Young Talent Support Program for Doctoral Students (the first session) of the China Association for Science and Technology (CAST). He serves as an Editorial Board Member of Scientific Reports, a Youth Editorial Board Member of International Journal of Hydromechatronics (IJHM) and Journal of Dynamics, Monitoring and Diagnostics (JDMD), a Guest Editor-in-Chief for several SCI journals, and reviewers for more than 30 prestigious international and domestic journals including Advanced Science. He has been ranked among the Top 2% Scientists Worldwide by Elsevier Stanford List. University homepage: https://me.sjtu.edu.cn/teacher_directory1/qinchengjin.html.