Special Session III

Special Session Basic Information:

专栏题目 Session Title	中文：光学光电子系统可靠性 英文：Reliability of Optical/Optoelectronic Systems

专栏介绍和征稿主题
Introduction and topics

中文：

随着先进光电技术的持续发展，光学系统及其核心器件已广泛应用于高端制造、航空航天、光通信、激光探测、医疗设备与智能感知等关键领域。作为这些系统的核心功能单元，半导体器件、激光器、光电探测器及集成光子器件的性能稳定性与寿命特性，直接决定了整机系统的可靠性、安全性与长期服役能力。然而，光学系统通常面临复杂应力环境、多物理场耦合作用以及退化机理多样化等挑战，传统可靠性分析方法在失效机理揭示、寿命预测与健康管理方面仍存在明显局限。

本专栏聚焦光学系统可靠性的前沿研究，重点关注半导体激光器、光电子器件与复杂光学装备在服役过程中的退化演化、失效分析、寿命建模、状态监测与可靠性增强方法，旨在推动可靠性工程、光电子技术与数据驱动方法的交叉融合。我们欢迎理论研究、实验研究、工程应用与案例分析等多种形式的稿件。特别鼓励围绕以下方向投稿：

- 半导体激光器与光电子器件的退化机理与失效物理
- 激光器、探测器与光学系统的寿命评估与可靠性建模
- 多应力耦合条件下的可靠性试验、加速退化分析与寿命外推
- 面向光学系统的故障诊断、状态监测与预测性健康管理
- VCSEL、DFB 激光器、边发射激光器及高功率激光器的可靠性研究
- 集成光子器件、光通信模块与先进封装结构的可靠性评价
- 光机电一体化系统中的可靠性设计、容错控制与鲁棒性优化
- 基于数据驱动与人工智能方法的可靠性分析、不确定性量化与剩余寿命预测

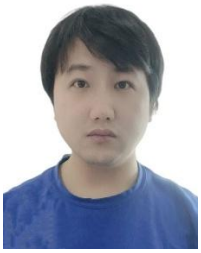
英文：With the continued advancement of photonic and optoelectronic technologies, optical systems and their core components are increasingly deployed in critical applications, including advanced manufacturing, aerospace, optical communications, laser sensing, medical devices, and intelligent perception. The performance stability and lifetime characteristics of semiconductor devices, lasers, photodetectors, and integrated photonic components directly determine the reliability, safety, and long-term service capability of the overall system. However, optical systems often operate under complex stress conditions, multi-physics coupling, and diverse degradation mechanisms. Conventional reliability methods remain limited in failure mechanism identification, lifetime prediction, and health management for such systems.

This session focuses on emerging research in the reliability of optical systems, with particular emphasis on semiconductor lasers, optoelectronic devices, and complex photonic equipment. It aims to advance the integration of reliability engineering, optoelectronic technology, and data-driven methodologies by addressing degradation evolution, failure analysis, lifetime modelling, condition monitoring, and reliability enhancement in service environments. We welcome theoretical studies, experimental investigations, engineering applications, and case studies. Contributions are particularly encouraged in the following areas:

- Degradation mechanisms and physics of failure in semiconductor lasers and optoelectronic devices
- Lifetime assessment and reliability modelling of lasers, photodetectors, and optical systems
- Reliability testing, accelerated degradation analysis, and lifetime extrapolation under multi-stress conditions
- Fault diagnosis, condition monitoring, and prognostics and health management for optical systems

- Reliability studies of VCSELs, DFB lasers, edge-emitting lasers, and high-power laser devices
- Reliability evaluation of integrated photonic devices, optical communication modules, and advanced packaging structures
- Reliability-oriented design, fault tolerance, and robustness optimisation in opto-mechatronic systems
- Data-driven and artificial intelligence methods for reliability analysis, uncertainty quantification, and remaining useful life prediction

Special Session Chair(s):



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Organizer's Brief Biography

中文：张驰知，博士，中国科学院长春光学精密机械与物理研究所先进计算与数字工程研究中心副研究员。曾任英国赫尔大学讲师、博士后，具有丰富的国际科研与教学经历。其研究聚焦于人工智能驱动的工程系统建模与智能体可靠性评估，涵盖退化建模、数字孪生、健康管理（PHM）与可信 AI 系统的跨学科融合方法。

作为“AI 智能体可靠性”研究方向的代表性学者，提出了多种适用于复杂光电装备的退化过程建模框架，拓展了可靠性工程中对 AI 决策系统可预测性与鲁棒性的研究边界。他主持和参与了多项国际合作项目，包括 EPSRC、中科院省基金项目等，并在国际顶级期刊会议发表论文三十余篇。

他现担任中国科学院高层次人才候选人、吉林省长白山青年人才、省级 D 类人才，具备扎实的工程建模基础与面向实际应用的 AI 算法开发能力。其研究目标致力于推动可信 AI 技术在智能制造、光电系统、无人系统等关键领域的可靠性评估与部署。

英文：Dr Chizhi Zhang is an Associate Professor at the Advanced Computing and Digital Technology Research Centre, Changchun Institute of Optics, Fine Mechanics and Physics (CIOMP), Chinese Academy of Sciences. He previously served as a Lecturer and Postdoctoral Research Fellow at the University of Hull, United Kingdom, and possesses extensive international experience in both research and teaching.

His research focuses on AI-driven modelling of engineering systems and the reliability assessment of intelligent agents, encompassing degradation modelling, digital twin development, prognostics and health management (PHM), and the interdisciplinary integration of trustworthy AI technologies.

As a leading researcher in the field of AI agent reliability, Dr Zhang has proposed a series of degradation modelling frameworks tailored to complex optoelectronic systems, thereby extending the boundaries of reliability engineering towards the predictability and robustness of AI-based decision-making systems. He has led and participated in several international collaborative projects, including those funded by the UK Engineering and Physical Sciences Research Council (EPSRC) and the Chinese Academy of Sciences.

Dr Zhang has authored over 30 research articles published in top-tier international journals and conferences. He has been recognised as a High-Level Talent Candidate by the Chinese Academy of Sciences, a Changbai Mountain Young Talent of Jilin Province, and a Provincial Class-D Talent. His work is underpinned by a strong foundation in engineering modelling and the development of application-oriented AI algorithms. His research aims to advance trustworthy AI technologies for reliability evaluation and deployment in critical domains such as intelligent manufacturing, optoelectronic systems, and autonomous platforms.

姓名 **Name**	Georgios Markou
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Organizer's Brief Biography

中文： Dr. Georgios Markou，塞浦路斯籍学者，现任塞浦路斯科技大学（CUT）土木与地理信息工程系教授，兼任比勒陀利亚大学副教授，曾任阿布扎比 ALHOSN 大学副教授、智利 UCSC 大学副教授，以及英国谢菲尔德大学访问研究员。早年在希腊国立雅典理工大学获得博士学位，长期从事计算力学、有限元建模与结构可靠性分析研究，具有深厚的土木工程与数值仿真背景。

近年来，Markou 教授将人工智能与结构工程深度融合，聚焦于 AI 驱动的结构健康监测、损伤识别、模型预测与工程系统可靠性建模等方向，探索 AI 智能体在结构诊断与维护决策中的可靠性边界问题。他开发的研究型有限元分析平台 ReConAn FEA，为复杂材料建模与结构响应预测提供了强大支撑，亦为 AI 智能体的可解释性与可信度评估奠定基础。

其研究覆盖面广泛，包括纤维增强复合材料建模、地基-结构相互作用、流固耦合、混凝土退化过程建模、大规模数值模拟与并行计算等，致力于推动 AI 技术在高可靠性结构系统中的可信部署。Markou 教授已在多个国际科研平台发表高水平成果，并具备丰富的项目经验与跨国工程咨询实践，现为塞浦路斯、南非等地注册工程师（Pr.Eng.）。

英文：Dr George Markou, currently serves as a faculty member at the Department of Civil Engineering and Geomatics, Cyprus University of Technology (CUT), and as a Research Associate at the University of Pretoria, South Africa. He previously held academic positions as an Associate Professor at ALHOSN University in Abu Dhabi and UCSC in Chile, as well as a Visiting Researcher at the University of Sheffield, UK. He holds a Ph.D. in Computational Mechanics from the National Technical University of Athens (NTUA), Greece, and has a strong background in finite element modelling, numerical simulation, and structural reliability.

In recent years, Dr Markou's research has evolved towards the integration of artificial intelligence with structural engineering, focusing on AI-enabled structural health monitoring (SHM), damage detection, predictive modelling, and the reliability assessment of intelligent agents embedded in civil infrastructure. His development of the research finite element software ReConAn FEA supports advanced simulation of complex materials and structural responses, providing a foundation for evaluating the interpretability, robustness, and trustworthiness of AI agents in critical engineering contexts.

His broader research interests span FRP material modelling, soil–structure interaction, fibre-reinforced concrete behaviour, seismic analysis of RC buildings and bridges, fluid–structure interaction, and large-scale computational mechanics using parallel processing. Dr Markou's goal is to promote trustworthy AI methodologies in structural decision-making systems, ensuring their reliable deployment in high-consequence civil infrastructure. He is a registered Professional Engineer with ETEK (Cyprus) and ECSA (South Africa), and has published widely in the field of computational mechanics and AI-driven reliability assessment.

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Organizer's Brief Biography

中文：廖文渊，高级工程师，2020 年在中科院半导体所获微电子学与固体电子学专业博士学位，目前就职于工业和信息化部电子第五研究所电子元器件可靠性技术全国重点实验室。主要研究方向为半导体激光器、铌酸锂调制器等光电子器件失效机理及可靠性评价技术。

英文： Wenyuan Liao received the Ph.D. in microelectronics and solid-state electronics from the Institute of Semiconductors, Chinese Academy of Sciences in 2020. He currently works at State Key Laboratory of Reliability Technology for Electronic Components, China Electronic Product Reliability and Environmental Testing Research Institute from 2020, as a senior engineer. His main research interests include failure mechanism and reliability evaluation technology of optoelectronic devices such as semiconductor lasers and lithium niobate modulators.