

Special Session XVIII

Special Session Basic Information:

| | |
|--|--|
| 专栏题目 Session Title | 中文：电子设备可靠性数字化评价方法：从器件到系统 英文：Digital Model based Reliability Assessment Methodology for Electronic Equipment: from Component to System |
| 专栏介绍和征稿主题 Introduction and topics | <p>中文：传统“设计-试验-改进-再试验”可靠性评价模式的周期长、成本高，已无法适应设备的快速开发节奏。利用数字仿真模型、失效物理建模和数据驱动预测算法等技术，可靠性数字化评价能够在设计初期预判产品性能演化规律，缩短研发周期，降低试验成本。可靠性数字化评价方法已成为学术界与工业界关注的核心。元器件是构建电子设备功能的基础单元，而设备的运行环境和系统负载则构成了驱动元器件失效的应力剖面。本分会场旨在探讨元器件到系统的可靠性数字评价方法。一方面，元器件的退化是系统失效的原因之一，其微观性能的劣化会通过电路逻辑和物理拓扑发生传递与累积，最终导致系统层面的功能失效或性能漂移。理解准确描述跨尺度传递机理，是可靠性数字化评价的关键。另一方面，极端应用工况也对元器件的可靠性评价方法提出了新要求，如何利用数字化技术将极端温变、高辐射等环境剖面映射到关键元器件维度，并准确预测剩余寿命，是实现电子设备可靠性数字化评价的另一关键问题。本分会场诚邀全球专家学者分享在“元器件-系统”维度的失效物理建模、加速试验数字化仿真、系统可靠性建模及智能运维等领域最新研究成果，共同推动电子设备可靠性评价向数字化、智能化转型。</p> <p>英文：The "Design-Test-Improve-Retest" paradigm for conventional reliability evaluation is characterized by prolonged cycles and high costs, making it inadequate for the rapid pace development. By applying simulation models, physics-of-failure(PoF), and data-driven algorithms, digital-model based reliability evaluation enables to predict the product performance in early stage, which significantly shortens R&D cycles and reduces experimental costs. Components serve as the fundamental functional units of electronic equipment, while the operational environment and system loads define the mission profiles that drive component failure. This session aims to explore digital reliability evaluation methodologies spanning from individual components to entire systems. On one hand, component degradation is one of root causes of system failure. Micro-level deterioration propagates and accumulates through circuit logic and physical topology, eventually culminating in system-level functional failure or performance drift. Accurately characterizing "component-system" propagation mechanism is important for digital reliability evaluation. On the other hand, extreme operating conditions impose new requirements on reliability evaluation. A critical challenge lies in using digital technologies to map environmental profiles, such as extreme temperature fluctuations and high radiation, onto key component dimensions to accurately predict remaining useful life (RUL). Participants will communicate and share in depth within research areas such as PoF modeling, simulation of accelerated testing, system-level reliability modeling, and intelligent operation and maintenance.</p> |

Special Session Chair(s):

| | | |
|--|------------------------------------|---|
|  | 姓名 Name | 路国光 Guoguang Lu |
| | 称谓 Prefix | 研究员，实验室副主任（主持工作） Research Professor, Vice Director |
| | 部门 Department | 电子元器件可靠性技术全国重点实验室 National Key Laboratory of Electronic Component Reliability Technology |
| | 单位 Organization | 工业和信息化部电子第五研究所 China Electronic Product Reliability and Environmental Testing Research Institute |
| | 城市/地区 City/Region | 广州，中国 Guangzhou, China |
| | | |

Organizer's Brief Biography

中文：路国光，研究员，国家重点研发计划国家质量基础(NQI)专项技术首席，在电子元器件可靠性机理表征与建模技术、可靠性试验与评估技术、可靠性设计与验证技术等方面获得了群体性技术突破，成系列自主研发 30 余台套可靠性试验仪器，创新成果先后获广东省科技进步一等奖等省部级科技奖励 7 项，组织或参与国标等标准编制 9 项。

| | | |
|--|-----------------------------|---|
|  | 姓名 Name | 牛皓 Hao Niu |
| | 称谓 Prefix | 高级工程师 Senior Engineer |
| | 部门 Department | 电子元器件可靠性技术全国重点实验室 State Key Laboratory of Reliability Technology for Electronic Components |
| | 单位 Organization | 工业和信息化部电子第五研究所 China Electronic Product Reliability and Environmental Testing Research Institute |
| | 城市/地区 City/Region | 广州，中国 Guangzhou, China |

Organizer's Brief Biography

中文：牛皓，高级工程师，2020 年获哈尔滨工业大学电气工程专业博士学位，2016 年 9 月-2017 年 10 月丹麦奥尔堡大学能源系联合培养博士生。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。主要研究方向为元器件可靠性数字化试验、退化建模、可靠性评价。

英文：Hao Niu received the Ph.D. degree in electrical engineering in 2020 from Harbin Institute of Technology, China. He was also a guest Ph.D. student with Department of Energy Technology, Aalborg University, from September 2016 to October 2017. He currently works at National Key Laboratory of Electronic Component Reliability Technology, China Electronic Product Reliability and Environmental Testing Research Institute from 2021, as a senior engineer. His research interests include digital reliability assessment, degradation modeling and reliability evaluation for electronic devices and system.

| | | |
|---|-----------------------------|---|
|  | 姓名 Name | 刘树林 Shulin Liu |
| | 称谓 Prefix | 研究员，首席专家 Research Professor, chief expert |
| | 部门 Department | 船舶质量与可靠性研究中心 Ship Quality and Reliability Research Center |
| | 单位 Organization | 中国船舶集团有限公司综合技术经济研究院 China Institute of Marine Technology and Economy |
| | 城市/地区 City/Region | 北京，中国 Beijing, China |

Organizer's Brief Biography

中文：刘树林，研究员，首席专家。长期从事装备通用质量特性技术的研究工作，主要研究方向为装备通用质量特性管理、设计分析、试验与评估。

英文：Shulin Liu, as a research professor and chief expert, has long been engaged in research on equipment generic quality characteristics technology, with main research directions including equipment generic quality characteristics management, design analysis, testing, and evaluation.