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Call for Papers for the Special Session on

Intelligent Defect Analysis, Quality Prediction, and Optimal Control for Precision Electronics Assembly

Organized and co-chaired by

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Technical Outline of the Session and Topics

The relentless drive toward miniaturization has rendered precision electronics assembly hypersensitive to microscopic deviations. In safety-critical applications, such as automotive, aerospace, and medical devices, near-zero defects are a non-negotiable mandate. Modern surface mounting assembly typically involves solder paste printing, component placement, and reflow soldering, each contributing to final product quality. For these multiple interrelated processes, traditional manual and passive quality control methods are inadequate, suffering from low efficiency, subjectivity, and a lack of real-time predictive capability.

This special session explores the integration of intelligent defect analysis, quality prediction, and optimal control by leveraging technologies such as physics-informed neural networks, multimodal fusion, and cyber-physical systems. By shifting from reactive correction to data-driven proactive prevention and control, these technologies enable interconnected assembly processes, facilitating precise adaptive control and optimization while reducing rework and enhancing reliability.

We solicit cutting-edge research and case studies to establish benchmarks, foster knowledge exchange, and accelerate the adoption of intelligent techniques for next-generation electronics assembly.

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

- Physics-informed neural networks for multiphysics modelling of solder joint defects
- Explainable AI for interpretable defect diagnosis and root cause analysis
- Multimodal deep learning for micro-defect detection and semantic segmentation
- Machine learning-based predictive analytics for defect forecasting across multiple processes
- Reinforcement learning for closed-loop quality control and adaptive process optimization
- Learning-guided multi-objective co-optimization of quality, throughput, and energy efficiency
- Few-shot learning and transfer learning for cross-product quality generalization
- Cyber-physical systems for real-time sensing, monitoring, and rapid actuation

Timeline for Authors

All the instructions for paper submission are available on the conference website. Please visit www.iecon2026.org or scan the QR code for the timeline.