

Special session: Intelligent Signals and Resilient Systems

Organizers:

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Automation and robotic systems are increasingly driven by intelligent signal processing and data-based decision-making. In practice, however, these systems operate under non-ideal sensing conditions: noisy measurements, sensor drift, miscalibration, partial failures, and strong variability due to human interaction or environmental changes.

Despite this, many testing, quality, and automation frameworks still assume clean signals and stable operating conditions, leading to fragile solutions that fail outside laboratory settings.

For automation, testing, and robotics, resilience must be addressed at the signal and measurement level, not only at the control or system architecture level.

This special session aims to bring together contributions that explicitly address:

- imperfect and uncertain signals,
- quality-aware sensing and testing,
- fault-resilient automation and robotic systems,
with a clear focus on industrial realism and deployability.

Topics of Interest

The session invites original research contributions (theoretical, methodological, or applied) including, but not limited to:

1. Intelligent Signals for Automation and Robotics

- Signal processing for robotic perception and actuation
- Intelligent feature extraction from industrial sensors
- Multimodal sensing (vision, force, EMG, IMU, vibration, etc.)
- Signal-driven AI for automation systems

2. Quality, Testing, and Measurement Integrity

- Signal-based quality assessment and monitoring
- Test strategies under noisy and uncertain measurements
- Sensor calibration, validation, and self-checking methods
- Measurement uncertainty modeling and propagation

3. Fault Detection and Resilience

- Signal-level fault detection and diagnosis
- Drift, ageing, hysteresis, and sensor degradation
- Robust estimation and decision-making under sensor faults
- Fault-tolerant and self-healing automation systems

4. Human–Robot and Cyber-Physical Systems

- Human-centered sensing in industrial robotics

- Variability and uncertainty in human-in-the-loop systems
- Safety, reliability, and trust in intelligent automation
- Explainable and trustworthy AI for testing and quality control

5. Applications and Case Studies

- Industrial robotics and flexible manufacturing
- Automated testing and inspection systems
- Smart factories and Industry 4.0 / 5.0
- Energy, healthcare, and infrastructure automation

Expected Contributions

The session particularly welcomes papers that:

- Address real industrial signals, not ideal datasets
- Explicitly integrate quality, testing, and reliability constraints
- Demonstrate robustness and resilience in automation or robotics
- Bridge signal processing, AI, and test engineering