



Kehityssuuntia koneturvallisuuden alueella: SIAS 2024



Safety of Industrial Automated Systems

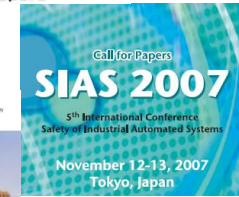
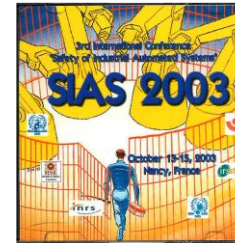
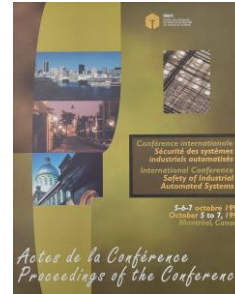
Timo Malm

VTT Technical Research Centre of Finland Ltd.

VTT – beyond the obvious

SIAS series of independent traditional conferences

The First SIAS conference was organized in
 Montreal 1999
 Bonn 2001
 Nancy 2003
 Chicago 2005
 Tokio 2007
 Tampere 2010
 Montreal 2012
 Königswinter 2015
 Nancy 2018
 Japan on-line 2021
 Tampere 2024



About SIAS

- The conference is concentrated on the **safety of automation** in machinery
- Presentations also on wider scope related to automation and occupational safety.
- This is the 11th conference, which indicates that the topic is important and there is still more to discuss and research.
- Earlier in SIAS conferences many new safety devices, methods and experiences of technology have been introduced. It has also been an excellent forum to test new safety-related ideas to the safety science community.
- The place where the research and engineering of the branch meet.
- The tradition will continue.

Safety of machinery

- Safety concepts and principles
- Design rules and strategy
- Engineering-ergonomics

Multi-disciplinarity in safety research

- Collaboration with autonomous machines

Risk assessment

- Hazard identification, historic experience, mitigation
- Methodologies

Practical applications/ experiences

- Accident analysis and investigation
- Economics of safety

Human and organizational factors

- Organizational design, management and leadership
- Socio-technical system approach to automation safety
- Safety culture
- Vision Zero
- Training, education and personnel qualification

Protective devices and systems

- Safety of autonomous machines, robots and cobots
- Intelligent personal protective equipment

Control system designs and evaluations

- AI and safety
- Digital twins
- Cybersecurity
- XR technologies improving safety

Standardization and regulations

- Standardization in the safety of machinery
- Effects of new EU regulations

Functional safety

- SIL's and PL's of intelligent devices
- Experiences of new functional safety standards

Number of presentations

Popular subjects were:

- Collaborative robotics
- Safety systems and protective systems
- Risk analysis and safety approaches

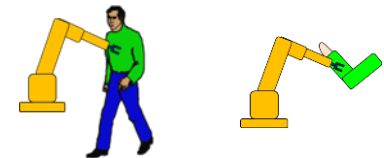
Topics	Number
Robots, collaborative robots	9
Cybersecurity	3
Risk analysis	5
Protective devices	6
Work environment	2
Safety systems	7
Mobile machinery	4
Item safety, safety approaches	7
Education	1
Human factors	4

Collaborative systems and cobots

- Persons work so near the machine or cobot that all collisions cannot be avoided -> **collisions are allowed**. Limit forces and pressures.
- Some impacts are acceptable if they does not hurt person (**force limits**) or pain is not too hard (pressure)
- **Industrial robot** may not hit a person, but cobot may. New aspect. What are the limits? How they are measured fairly? Same limits for similar cases.
- Many aspects affect the **feeling of force**: gender, time, new happening, first time hurts most, cultural differences (shame associated to Far East cultures),
- There is a problem related to human robot collaboration requirements. How to measure limits? Are we protecting weakest or normal workers? Should we limit the extreme hazards or concentrate on good feeling? How to value bruises, shame of failing collision.

Yhteistyörobotit ovat tulossa, mutta

- Ihmiseen kohdistuva voima törmäyksissä on vaikea osoittaa
- Osuma päähän ei sallittu, vaikea osoittaa, ettei mahdollista
- Hyvinvoinnin kokemus; japanilainen näkökulma?



Risk assessment

- **Automated risk assessment**, AI in risk assessment detection of sharp or dangerous devices, model-based safety validation – not yet allowed
- **Good feeling** related to work, Anshin (peace of mind), relation between safety and happiness, positive safety
- **Negative** domain is related to minimizing extreme safety issues, bottle-necks of mental and physical safety – **Positive** domain is related to liberation from potential hazard and general well-being, mental safety, how to measure well-being?
- **Person qualification** systems, education (Työturvallisuuskortti),
- Towards **knowledge-based standards**
- ISO 13849-1 does not allow the contribution of human to safety – collaboration difficult (ihmisen vaikutus turvallisuuteen)
- **AI-based** safety device for saw blades
- Roaming **Wireless Safety** Emergency Stop – safety-related signal path changes as machine moves

Safety systems and protective systems

AI in safety systems

Collaboration M2H

Safety RADAR

Wireless safety systems

Risk assessment of a safety system on-line

Conclusions - Future

New requirements (Machine Regulation (EU) 2023/1230...)

If humans and machines work close to each other we need:
quick and reliable perception, quick stopping or other way to diminish the risk (force, new direction)

New (?) safety devices: LIDAR, RADAR, camera-technology, combination, AI-based processing, dynamic access control, new technology/approach ...

AI-based risk assessment, automated risk assessment - certified risk analysts
– accepted risk assessment process

Negative risks vs. positive feelings in work?

Thank you for your attention!

Questions?

VTT – beyond the obvious

10



Timo Malm
Senior Scientist, MSc. (Tech)
System Safety

Tel. +358 20 722 3224
Email: timo.malm@vtt.fi

VTT Technical Research Centre of Finland Ltd
Visiokatu 4, Tampere
P.O. Box 1300
FI-33101 Tampere, Finland

www.vttresearch.com