AI - TEF for the manufacturing sector in Slovenia –

TEF centers at the University of Ljubljana and Jožef Stefan Institute

Prof. dr. Niko Herakovič
University of Ljubljana, Faculty of Mechanical Engineering
February 28, 2022

The PPT presentation available at: https://web.fs.uni-lj.si/lasim/index.php?page=tef
Excellence

Our team provides unique expertise in manufacturing and production sector that addresses the challenges of Artificial Intelligence, Factories of the Future, Robotics, Digital twins and Agents etc. across all the TRLs, from basic research to real-life applications and is composed of two leading R&D institutions in Slovenia:

- University of Ljubljana (Faculty of Mechanical Engineering) – UL FME
- Jožef Stefan Institute – JSI

I. University of Ljubljana (Faculty of Mechanical Engineering)
- The capacity of the team in this field is more than 80 experts, including PhD students, post-docs, and senior researchers, with numerous scientific articles and citations.
- We participated in more than 35 international and national R&D projects and in hundreds of industrial projects.
- We provide more than 5 million EUR of dedicated state-of-the-art equipment that facilitates both R&D and practical challenges, also test-before-invest to help companies (transfer of knowledge).

II. Jožef Stefan Institute
- Leading research institute in Slovenia with more then 1000 workers with a revenue of cca. 57,4 million EUR, own activities 15,2 million EUR, from own activities 51% direct industrial projects and 6 ERC projects.
- Robotics department has more then 40 experts, with excellent international scientific results, large and state-of-the-art laboratory facilities and equipment.
- Currently we provide 6 EU projects (2 project coordination), additionally also industrial projects on this field with numerous scientific articles and citations.
- ...
What we use, provide and transfer to manufacturing sector

- Artificial Intelligence and Smart Algorithms
- Distributed Systems and Edge Computing
- AI based Digital Twins and Agents for autonomous decision making
- Flexible, Agile, Reconfigurable Robotic and Cobotic Cells
- Smart Production, Manufacturing (ERP-MES-Digital twin interconnectivity)
- Experimental and Testing and facilities
- Modelling, Simulation, Data Analytics
- AR and VR
- Architectural Models, Smart Factories, Communication Protocols and 5G)
AI-based Edge Computing Concept in the R&D, Experimental, Testing and Demonstration Facility (RDTEF) at the University of Ljubljana, Faculty of Mechanical Engineering (UL FME)

Legend
- Direction of material flow
  - Workstation
- Information flow between nodes
  - Warehouse
- Information flow between a node and an element of the assembly line
  - Manual workstation

AI based - Edge computing - on the manufacturing operation

Node 1

Node 2

Node 3

Node 4

Node 5

Node 6

Node 7

Node 8

Cloud

AI based - Global/Central Digital twin and Digital Agent in the local Cloud
Robotic at Jožef Stefan Institute

Main research topics: Robot learning and cognitive robotics, Human-robot collaboration, Humanoid robotics, Dual-arm manipulation, Industrial robotics and automation supported by AI

A Reconfigurable robot workCell for fast set-up of assembly processes in SMEs

Advanced Robotics for Agile Production in Future Manufacturing Ecosystems

Self-reconfiguration of a robotic workcell for the recycling of electronic waste

- Design a new kind of an autonomous robot workcell.
- Attractive not only for large production lines but also for few-of-a-kind production, which often takes place in SMEs.
- Passive reconfigurable hardware design, programming by demonstration, force control, simulation, and visual monitoring for fast set-up of robotic workcells.
- Coordinated by Jožef Stefan Institute

- Robot aided reconfiguration
- Intelligent modularisation
- Coordinated by Jožef Stefan Institute
Impact: Activities in Knowledge & Technology transfer to industry

- We have provided education and hand-on training of experts from industry for more than 50 companies from Slovenia, Croatia, Austria, Italy and the Czech Republic.
- We transferred knowledge to more than 100 companies through industrial projects in Slovenia, Germany, and neighboring countries.
- We have access to more than 100 companies through our networks in Slovenia (SRIP FoF cluster, DIH JSI, CTT at JSI).
- We have access to more than 100 companies through our networks in the EU (EU DIH Trinity, RIA, EFFRA).
- We have a contract with Slovenian Chamber of Commerce (GZS) and with Strategic Research and Innovation Partnership Factories of the Future (SRIP FoF).
- We are members of Technological Network of Companies for Control Technologies with significant membership.
- We have established Digital Innovation Hub (DIH-DITMAPS) for digital twins of logistics systems and manufacturing processes and systems.
- We are members of Slovenian Innovation Hub (DIH Slovenia).
- JSI is a regular member of EIT Manufacturing, EFFRA, RIA, WMF.
- ...
Thank you for your attention!

Co-ordinates:
Prof. dr. Niko Herakovič
E-mail: niko.herakovic@fs.uni-lj.si
Tel.: +386 1 4771 726

Laboratory LASIM, Faculty of mechanical Engineering, University of Ljubljana

https://web.fs.uni-lj.si/lasim/
https://dih-ditmaps.si/