

FRAMEWORK PROGRAMME OF EARLY STAGE RESEARCHER TRAINING¹

1. BASIC DATA

Mentor's name and surname	Nataša Vujica Herzog	Mentor's register number at <u>ARIS</u> (<u>SICRIS):</u>	17111
Mentor's e-mail:	natasa.vujica@um.si	Mentor's tel. no.:	02 220 7635
Research programme (RP) leader's name and surname:	Bojan Ačko	RP leader's register number at <u>ARIS</u> (<u>SICRIS)</u> :	06673
Title of research programme:	Advanced concepts of production management and dimensional metrology	RP's Register number at <u>ARIS</u> <u>(SICRIS):</u>	P2-0190
Research organisation (RO) of University of Maribor, where training shall be conducted:	UM FME	RO Register number at <u>ARIS</u> (SICRIS):	0795
Research field according to <u>ARIS classification</u> :	2.10.05 Manufacturing technologies and systems – Industrial engineering	Research field according to Ortelius classification (EURAXESS)	CODE: 15.14 Industrial engineering ID: 177

2. DEFINITION OF RESEARCH PROBLEM AND GOALS OF DOCTORAL RESEARCH²

Starting point of research task of the early stage researcher and its position in the research programme, where the mentor is included, work hypothesis, research goals and foreseen result with emphasis on an original contribution to science:

The research problem resolves around the integration of real-time motion capture systems, digital twins, and ergonomics within different work environments. Motion capture, often abbreviated as Mocap, is a technique used to record, analyse and transfer the movements of people or objects into a digital format. When the person moves, the sensors enable accurate tracking of positions and orientations in real-time. For our research, the Xsens suit (RIUM) will be used to capture the

¹ Term early stage researcher (ESR) is written in male form and used as neutral for women and men.

² Research and study programme of training have to harmonise with contents of the research programme, where the mentor is a member.

worker's movements and then analyze them using various ergonomic analyzes available in the Process Simulate program (Siemens PLM Software).

Real-time motion capture systems enable continuous monitoring of human movements, while digital twins provide virtual representations of physical spaces and objects. Research aims to explore the synergy of these technologies in addressing ergonomic challenges in workplace design, with a particular focus on the evolving issues associated with aging population and workers with disabilities.

The area of ergonomic workplace design is one of the research areas within the research program of the software group P2-0190 (Advanced Concepts in Production Management and Dimensional Metrology). The young researcher's research results will therefore make a significant contribution to achieving the program's objectives.

Work hypothesis: Real time ergonomics assessment, facilitated by the integration of motion capture technology and digital twins, can significantly contribute to the optimal design of work environments by taking into account worker's constraints and capabilities.

It is expected that continuous monitoring and analysis through real-time motion capture, coupled with the dynamic representation of physical spaces through digital twins, will provide actionable insights for the design of workspaces that improve efficiency, comfort, and overall well-being, especially considering the various diverse limitations of workers. The hypothesis is that the synergy of these technologies will enable a proactive and adaptive approach to ergonomic design, that ultimately promotes a more inclusive and supportive work environment.

Research objectives and anticipated outcomes with emphasis on the original contribution:

- Evaluate real-time motion capture technology; assess the capabilities and limitations of real-time motion capture systems considering factors such as accuracy, latency and adaptability to different work environments. Investigate how these systems contribute to the continuous and dynamic monitoring of human movement.
- Explore the integration of digital twins; investigate the integration of digital twins with realtime motion capture technology. Evaluate how digital twins can improve the representation and analysis of physical workplaces, enabling a more comprehensive understanding of ergonomic factors.
- Identify ergonomic challenges in real time; identify and analyze ergonomic challenges faced by people in different work environments in real time. Consider factors such as instant feedback, adaptability to changing working conditions and the role of digital twins in exploring ergonomic issues.
- Anticipate and investigate future ergonomic challenges; with particular attention to the impact of an aging population and workers with disabilities. Evaluate how real-time motion capture and digital twins can proactively address these challenges.
- Develop real-time adaptive solutions; propose adaptive solutions that utilize real-time motion capture and digital twins for immediate ergonomic interventions. Explore how these technologies can dynamically adapt work environments to different needs and promote health and efficiency.
- Create interactive digital twin environments; develop interactive digital twin environments that allow stakeholders to virtually experience and manipulate ergonomic settings. Evaluate the usability and effectiveness of these interactive representations in identifying and mitigating ergonomic issues.
- Articulate human-centered design principles; formulate design principles that emphasize human-centered considerations in real-time motion capture, use of the digital twin, and ergonomic solutions. The goal is to create work environments that promote well-being and performance while respecting individual diversity.

3. STUDY PROGRAMME

Foreseen study programme, to which early stage researcher shall be enrolled in academic year 2025/2026:

PhD Study Program, 3rd Cycle Doctoral School, Faculty of Mechanical Engineering

- 2025/2026: Obligations of the 1st year according to the current curriculum, gathering and studying resources.
- 2026/2027: Obligations of the 2nd year, application for the approval of the dissertation topic, research, the opportunity for scientific research and training abroad.
- 2027/2028: Obligations of the 3rd year, conclusion of research, dissertation writing.
- 2028/2029: Publication of articles and defense of the dissertation all completed within 4 years.

4. DESCRIPTION OF WORK AND TASKS

Implementing projects of scientific research. Taking part in the design of research programmes. Cooperating with research sponsors. Drawing up research and other reports. Monitoring and coordinating research work according to the grant agreement. Ensuring safety and health at work. Organising and instructing employees and students on using personal safety equipment and other safety measures. Performing other tasks at the behest of the superiors. Participating in ad-hoc and permanent committees of university or faculty bodies. Acting on behalf of colleagues and superiors during their absence (upon authorisation). Participating in annual and other inventories. Desting a dependent by superiors.

Performing other related tasks delegated by superiors.

5. REQUESTED LEVEL OF EDUCATION

VII/2. tariff group

6. REQUESTED FIELD OF EDUCATION

Technical, Natural sciences

7. KLASIUS SRV

Seventh level: Second cycle of higher and similar education/Second cycle of higher and similar education

8. KLASIUS P

145 – Education of teachers of individual subjects

- 340 Business and Administrative Sciences (not specified)
- 4 Natural science, mathematics and computing
- 5 Engineering, manufacturing and construction

9. REQUESTED KNOWLEDGE

Computer skills: MS Windows, Word, Excel, Internet, e-mail, e-commerce

10. REQUESTED SPECIAL REQUIREMENTS

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11. REQUESTED LANGUAGES

Active knowledge of one world language

12. REQUESTED WORK EXPERIENCE

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13. FORESEEN POSTDOCTORAL TRAINING

Kliknite ali tapnite tukaj, če želite vnesti besedilo.

Mentor's signature:

Research programme leader's signature:

Name and surname of Dean or authorised person³: red. prof. dr. Matej Vesenjak

Signature of dean or authorised person:

³ The training program is signed by the dean of the member where the ESR's employment and training will take place.

Place and date:

Maribor,

14. 01. 2025

Stamp: