Report on ERF2023 workshop #49 - 10th Workshop on Hybrid Production Systems – Part 1

WS # 49

10th Workshop on Hybrid Production Systems – Part 1

Organisers:

Name	e-mail	Gender (he/him, she/her, they/them)	Organisation name	Organisation Type (Academic, RTO, Large Industry, SME)	euRobotics member? Yes/No
Sotiris Makris	makris@lms.mech.upatras.gr	Male	LMS, University of Patras, Greece	Academic	Yes
George Michalos	michalos@lms.mech.upatras.gr	Male	LMS, University of Patras, Greece	Academic	Yes
Ramez Awad	ramez.awad@ipa.fraunhofer.de	Male	Fraunhofer-IPA	RTO	Yes
Iñaki Maurtua	inaki.maurtua@tekniker.es	Male	TEKNIKER	RTO	Yes

Speakers/Panellists (please complete, ideally with First Name, Surname(s), Gender (he/him, she/her, they/them), Organisation name, Organisation Type (Academic, RTO, Large Industry, SME)

1. Dr. George Michalos – Male – LMS-University of Patras – Academic
2. Dr. Paul Chippendale – Male – FBK-Bruno Kesler Institute – RTO
3. Dr. Ander Ansuategi – Male – TEKNIKER – RTO
4. Dr. Jon Onativia – Male – TECNALIA – RTO
5. Dr. Mohammad Alkhatib – Male – SIGMA – RTO
6. Prof. Giovanni Berselli – Male – University of Genova – Academic
7. Dionisis Andronas – Male – LMS-University of Patras – Academic
8. Dr. Christian Eitzinger – Male – Profactor GmbH – RTO

Key questions to be discussed and answered by the WS

- What are the latest technologies developed in the HPS?
- Which are the main challenges that the above technologies could address?
- What are the barriers that prevent the researchers/developers to apply those technologies and overcome the challenges?

WS description

The workshop consisted of two sessions focused on handling operations. In the first session, a series of 5-min, targeted presentations on intelligent workpiece handling has been made, creating a panel of 4 presenters that interacted with the audience for 20-minutes. In the second session, a series of 4-min, targeted presentations on handling flexible materials have been made, creating a panel of 4 presenters that interacted with the audience for 20-minutes. To prevent inhomogeneity and delays, a common presentation was used with slides from all the presenters targeting a key technology, a main challenge and the barriers faced. In the end, the audience has been engaged in an open dialogue with the panel speakers (including both academic and industrial people) using slido to identify the milestones achieved so far and the key challenges to be addressed in the next years.

Highlights from the workshop (max 400 words)

Note: Describe the key highlights or major points of interest that emerged from the workshop and the discussions. In particular note anything that altered your perspective or thinking on the topic and note anything that may be of interest to the wider robotics community.

Session 1:

This session involves representatives from the projects AGILEHAND, MASTERLY, HARTU and SMARTHANDLE. These projects presented key challenges and enabling technologies on intelligent workpiece handling deriving from their industrial use cases and end-user needs. The presenters outlined important specifications as set by their industrial partners. In parallel, the presentations elaborated on the technological modules besides the integrated solutions. Special focus was given to the topics of machine learning for classification/grading, soft robotics for selecting, adaptable conveyors for grading and moving, modular grippers, AI driven advanced control and perception, interoperable h/w and s/w architecture, soft grippers with electro-active fingertips, grasp planning policies identification and control. For many of the aforementioned topics, the advances in machine learning and how artificial intelligence can tackle challenges related to non-rigidity were discussed. The workshop concluded with an interactive panel discussion where the speakers shared their experiences and outlook on robotics and deformable object handling along with future directions for industrial and academic communities.

Session 2:

This session involves representatives from the projects SOFTMANBOT, REMODEL, MERGING and DRABEBOT. These projects presented key challenges and enabling technologies on flexible materials deriving from their industrial use cases and end-user needs. The presenters outlined important specifications from the tyre manufacturing, harness and cabling, and composites industries. In parallel, the presentations elaborated on the technological modules besides the integrated solutions. Special focus was given to the topics of tooling, sensing, multi-modal perception, flexible material modelling, co-manipulation of deformable objects, robot motion planning, and non-rigid object behavior prediction. For many of the aforementioned topics, the advances in machine learning and how artificial intelligence can tackle challenges related to non-rigidity were discussed. The workshop concluded with an interactive panel discussion where the speakers shared their experiences and outlook on robotics and deformable object handling along with future directions for industrial and academic communities.

Conclusions and/or next steps (max 300 words)

Note: State what you concluded from the workshop and what the next steps or outcomes from it are. For example; do you plan to hold a follow-up meeting, will this inform grant proposals, can you deliver a newsletter article, did the meeting allow attendees to make new connections, was there a clear overview of the current state of the art, or a vision for the future?

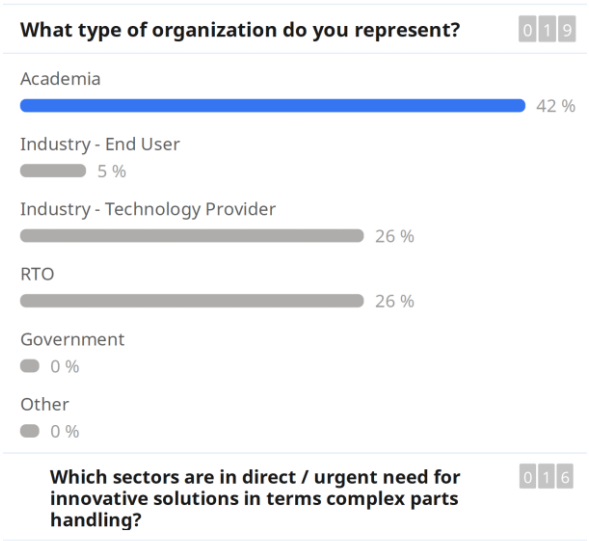
Session 1:

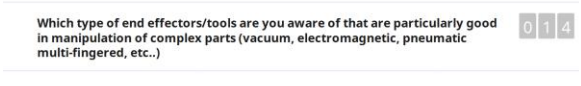
Inspired by the targeted presentations of each project, the speakers had a fruitful discussion where they shared their thoughts and experiences on key technologies on intelligent workpiece handling. The conclusion of the panel discussion, in conjunction with the feedback from the audience, is that there is a huge need for smart handling solutions in multiple sectors, especially in the ones that require the manipulation of complex parts with different characteristics such as the logistics, recycling and food sectors. In order to achieve this, key findings suggest that future activities should focus on improving different types of technologies through R&D activities, especially focused on basic grasping principles such as using vacuum, multi-fingered approaches, jamming grippers etc. Last but not least, the expectations from AI have been discussed, where the audience focused on two key aspects, on the one side on improved grasping ways and on the other side on improved perception capabilities to know how to perform and from which points a part can be handled. The projects will continue their synergies within the Hybrid Production Systems cluster. Through the cluster they will communicate their results through public events or workshops. The projects have already expressed their interest in participating in future HPS workshops by presenting their latest activities and outcomes.

Session 2:

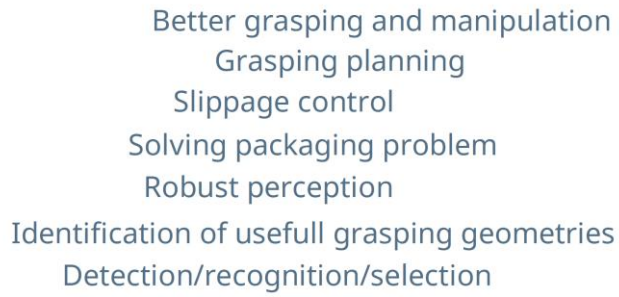
Inspired by the targeted presentations of each project, the speakers had a fruitful discussion where they shared their thoughts and experiences on key technologies in robotics for flexible material handling. The conclusion of the panel discussion, in conjunction with the feedback from the audience, is that there is still a lot of potential in flexible material handling robotics. Despite significant efforts in recent years, and diverse implementations, the maturity of solutions hasn't reached a threshold that would allow industries to adopt such solutions. Key findings suggest that future activities should focus on improving robot tools as well as sensor hardware. Moreover, engineers should improve dynamic motion planners, modelling techniques and perception modules towards cognitive and proficient handling of non-rigid workpieces. By answering the audience's feedback regarding the industries that still lack automation, and the reasons behind this notion, the speakers expressed that there is long way until standardization activities share directives for industrial settings. Finally, the benefits and handicaps of machine learning were outlined, highlighting a fertile ground for future project activities. The projects will continue their synergies within the Hybrid Production Systems cluster. Through the cluster they will communicate their results in the context of public events or workshops. The projects have already expressed their interest in participating in future HPS workshops by presenting their latest activities and outcomes.

Feedback in the interactive session – Session 1:





What enhancements related to complex part handling can be expected with the use of AI? (e.g. better in-hand control, efficient task planning or any other you can think of...) 007

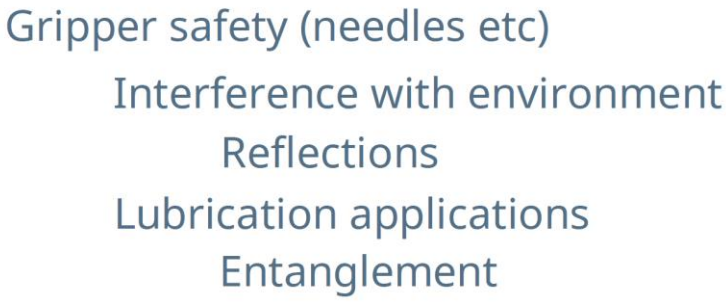


Feedback in the interactive session – Session 2:

Which manufacturing applications involving deformable objects still present the greatest automation potential? 010

Which enabling technologies in deformable object handling could machine learning improve? (e.g., co-manipulation) 008

Have you identified areas or examples where non-rigidity objects affected safety systems? 004



You can add links to websites, videos etc. here:

Previous Workshops:

- ERF2014 - Hybrid Production Systems: https://www.hybrid-production-systems.eu/portofolio/erf/
- ERF2015 - Hybrid Production Systems: https://www.hybrid-production-systems.eu/e/
- ERF2016 - Hybrid Production Systems: https://www.hybrid-production-systems.eu/erf-2016/
- ERF 2017 – Hybrid Production Systems: https://www.hybrid-production-systems.eu/erf-2017/
- ERF 2018 – Hybrid Production Systems: https://www.hybrid-production-systems.eu/erf-2018/
- ERF 2019 – Hybrid Production Systems: https://www.hybrid-production-systems.eu/erf-2019/
- ERF 2020 – Hybrid Production Systems: https://www.hybrid-production-systems.eu/erf-2020/
- ERF 2021 – Hybrid Production Systems: https://www.hybrid-production-systems.eu/erf-2021/
- ERF 2022 – Hybrid Production Systems:https://www.hybrid-production-systems.eu/9th-workshop-on-hybrid-production-systems/

Project Websites:

- AGILEHAND: https://agilehand.eu
- MASTERLY: https://www.masterly-project.eu
- HARTU: https://www.hartu-project.eu
- SMARTHANDLE: https://smarthandle-project.eu
- SOFTMANBOT: https://softmanbot.eu
- REMODEL: https://remodel-project.eu
- MERGING: https://www.merging-project.eu
- DRAPEBOT: https://www.drapebot.eu

Workshop website:

- https://www.hybrid-production-systems.eu/erf-2023/

If you are planning future publications or meetings (or would like to organise a more focused event such as a TG driven webinar) please let us know here.

Organize in ERF 2024 the 11th HPS as a follow-up workshop.

If you like the euRobotics' communication team to contact additional people apart from the organisers to discuss collaboration/dissemination in order to maximise the impact of your workshop, please add them here

Name, affiliation and e-mail of additional contact person(s): N/A