WearRAcon EUROPE

October 5–7, 2021

Virtual

Presented by:

WearRA WEARABLE ROBOTICS ASSOCIATION

Fraunhofer IPA

University of Stuttgart
Institute of Industrial Manufacturing and Management IFF

All about industrial exoskeletons!

A growing number of incredible exoskeleton solutions from a very dynamic young exo industry is entering the market. And there is more to come! At **WearRAcon Europe 21** you will hear about new solutions, functions and their acceptance and ergonomics. The virtual conference will show latest from research, industrial use cases and healthcare bodies perspectives. The young end users and their physical health is a main topic at our live experiments at **EXOWORKATHLON** ®. We are looking forward to reporting to you during the conference and share the results on day 3 of over 20 young experts in 4 sets of work tasks and their outcomes.

None of this would be possible without the support of our sponsors, members and attendees.

Thank you.

Sincerely,

Urs Schneider, Director,
Medical and Biotech Section,
Fraunhofer IPA

WearRAcon Europe Conference President

AGENDA AT A GLANCE Times are GMT +2. Hyperlinks are shown in LIGHT BLUE.

Tuesday, October 5, 2021

09:00 - 09:15	**WELCOME SPEECH:** Dr. Urs Schneider, Fraunhofer IPA, Germany
09:15 - 10:15	**KEYNOTE SPEECH:** Prof. Dr. Michiel de Looze, TNO, The Netherlands Reducing the barriers for implementation of exoskeletons in practice
10:15 - 10:25	**BREAK**
10:25 - 11:00	**LIVE FROM EXOWORKATHLON I:** Dr. Urs Schneider, Fraunhofer IPA, Germany: Live report from the Exoworkathlon
11:00 - 11:10	**BREAK**
11:10 - 12:10	**SESSION BENCHMARKING & ASSESSMENT I:** Dr. Ulrich Glitsch, Institut für Arbeitsschutz der DGUV, Germany: Challenges in the biomechanical assessment of industrial exoskeletons Dr. Jawad Masood, CTAG, Spain: Benchmarking occupational exoskeleton: Lessons from testbed development for confined industrial space Mathilde Schwartz, INRS, France: Cardiorespiratory effects of using a robotic back-support exoskeleton during a repetitive lifting task
12:10 - 13:00	**LUNCH BREAK**
13:00 - 13:30	**IMPULSE TALK I:** Prof. Dr. Klaus Bengler, Technische Universität München, Germany: Assistance Systems – A Challenge for Development and Evaluation
13:30 - 14:10	**SESSION HUMAN FACTORS & ACCEPTANCE:** Prof. Dr. Cordula Kropp, Universität Stuttgart, Germany I E: reasons and methods for user involvement Jérémy Lefint, KIT-ITAS/Fraunhofer IPA, Germany: WHO accepts WHAT? - The dilemma of subjectives factors and their integration into the product development process
14:10 - 14:20	**BREAK**
14:20 - 15:05	**LIVE FROM EXOWORKATHLON II** **LIVE SPOTLIGHT DEMO FROM LAEVO:** Georg Wagner, StraightWalk GmbH, Germany: Introducing Exxowear: A novel distribution platform for exoskeletons
15:05 - 15:15	**BREAK**
15:15 - 16:20	**SESSION BENCHMARKING & ASSESSMENT II:** Terry Buttler, Lean Steps Consulting, USA & Prof. Dr. Jason Gillette, Iowa State University, USA: Upper Body Exoskeleton Benchmark and Assessment Best Practices Lennart Ralfs, Universität Innsbruck, Austria: Evaluation of Industrial Exoskeletons - Methodology and Exemplary Results

Wednesday, October 6, 2021

09:00 - 09:10	**MORNING GREETINGS:** Christophe Maufroy, Ph.D., Fraunhofer IPA, Germany
09:10 - 09:40	**IMPULSE TALK II:** Jesùs Ortiz, Ph.D., IIT, Italy, Developing exoskeletons for the industry of today and tomorrow
09:40 - 10:40	**SESSION EXOSKELETON RESEARCH:** Prof. Dr. Simona Crea, Scuola Superiore Sant'Anna, Italy Occupational exoskeletons: challenges, opportunities, and lessons learned Prof. Dr. Carlos Rodriguez Guerrero, VUB, Belgium The Exo4Work project. Methods, Results and lessons learned Mark Tröster, Fraunhofer IPA, Germany: ExoPflege – Development of an active exoskeleton to support the human trunk- and shoulder-arm-system
10:40 - 10:50	**BREAK**

Wednesday, October 6, 2021 *(continued)*

10:50 - 11:20	**LIVE FROM EXOWORKATHLON III:** Dr. Urs Schneider, Fraunhofer IPA, Germany: Live report from the Exoworkathlon Dr. David Duwe, Ottobock SE & Co. KGaA, Germany: The Paexo Back Exoskeleton
11:20 - 11:30	**BREAK**
11:30 - 12:10	**SESSION EXOSUIT RESEARCH:** Dr. Maziar Sharbafi, Technische Universität Darmstadt, Germany Morphology and compliance roles in designing exosuits Jan Kuschan, Fraunhofer IPK, Germany Realtime Action Recognition as a basis for Smart Exosuits
12:10 - 13:00	**LUNCH BREAK**
13:00 - 13:30	**POSTER PRESENTATION SESSION**
13:30 - 13:40	**BREAK**
13:40 - 14:20	**IMPULSE TALK III:** Israel Benavides, Ford Europe, Germany Scientific studies on Exoskeletons at Ford
14:20 - 14:50	**SESSION EXOSKELETON SYSTEMS:** Daniel Rivera, Iturri S.A, Spain: The Prexer Thumb Exoskeleton HeroWear, USA: The Apex Exosuit
14:50 - 15:00	**BREAK**
15:00 - 16:00	**SESSION DIGITAL BIOMECHANICS:** Prof. Massimo Sartori, University of Twente, The Netherlands Musculoskeletal Modelling for Bio-Protective Robots Prof. Dr. Michael Skipper Andersen, Aalborg Uni, Denmark Design and analysis of exoskeletons with musculoskeletal models Prof. Dr. Lars Fritzsche, imk automotive GmbH, Deutschland Assessing the efficiency of exoskeletons in physical strain reduction by biomechanical simulation with AnyBody Modeling System

Thursday, October 7, 2021

09:00 - 09:10	**MORNING GREETINGS:** Christophe Maufroy, Ph.D., Fraunhofer IPA, Germany
09:10 - 09:40	**IMPULSE TALK IV:** Dr. Ralph Hensel, Audi AG, Germany Occupational Exoskeletons in the Gap Between Expectations and Reality
09:40 - 10:30	**END-USER FORUM I:** Anke Richter, Weldplus, Germany & Christiane Pohlmann, SLV Nord, Germany Support of ergonomics during welding by using augmented reality tools Simon Riela & Simon Kaesmann, Hilti Corporation, Liechtenstein Improving health and safety in construction using exoskeleton technology – Chances and Challenges from Hilti's perspective
10:30 - 10:40	**PAUSE**
10:40 - 11:20	**END-USER FORUM II:** Dr. Enrique Bances P., University of Stuttgart, Germany Integrative Computational Design and Construction (IntCDC): Opportunity and Challenges for Exoskeletons Developers Dr. Petra Abele, Sozialversicherung für Landwirtschaft, Forsten und Gartenbau, Germany: Exoskeletons in agriculture, forestry and horticulture
11:20 - 12:10	**EXOWORKATHLON RESULTS:** The Exoworkathlon Team, Fraunhofer IPA & Universität Stuttgart, Germany
12:10 - 12:20	Ivania Portillo-Elzer, Messe Düsseldorf GmbH Exoskeleton-October and Robotics Park at A+A 2021
12:20 - 12:30	**CLOSING WORDS:** Dr. Urs Schneider, Fraunhofer IPA, Germany

EXOWORKATHLON

Physical work with exoskeletons— A live performance

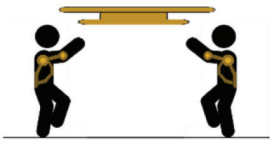
Industrial exoskeletons are fascinating new systems. They have the potential to protect against physical overload, reduce sick days, improve the quality of work and increase the satisfaction and quality of life of the workers. The EXOWORKATHLON® aims to demonstrate the potential of industrial exoskeletons in simulated use cases and, above all, to encourage mutual exchange on this exciting topic.

Four tasks with back-supporting and upper body exoskeletons are devised to collect, show and discuss data related to user feedback, ergonomics, metabolism/energy consumption and production quality. In Task 1, manual box handling, a typical back-stressing work process from logistics, is considered. Task 2 includes various overhead assembly activities, which are particularly stressful for the upper extremities. In Task 3 is the focus on welding with the reproduction of real welding tasks in a constrained position, which can induce high stress in the upper extremities. Task 4 includes a representative group-work activity from timber construction, in which two people must assemble wooden beams and strips at overhead height. These tasks are carried out twice by young workers (trainees and technical students) - once with and once without an exoskeleton. This enables an intra-individual anonymous evaluation of the effects of exoskeleton support, based on the different assessment and methods used for the different tasks.

TASK 1
Box handling

TASK 2
Overhead assembly

TASK 3
Welding



TASK 4
Collaborative assembly

The EXOWORKATHLON® is taking place on October 5 – 6 in Stuttgart in parallel to the virtual We-arRAcon Europe. The proceeding of the event will be reported live during the conference and first results will be presented on the third conference day.

We warmly thank the individuals who contributed to the elaboration of the event (Dr. Ralph Hensel (AUDI AG), Dr. Sascha Wischniewski (BAuA), Dr. Ulrich Glitsch (DGUV IFA) and Christiane Pohlmann (SLV Nord)) as well as the companies and institutions participating to and supporting the event:

Participating companies

ottobock. laevo exoskeletons HUNIC German Bionic skelex RB3D LEVITATE TECHNOLOGIES, INC.

Event supporters

GoX LABS xsens WELDPLUS AUGMENTED TRAINING & SOLUTIONS Audi WILHELM MAYBACH SCHULE STUTTGART

Keynote & Special Speakers

KEYNOTE PRESENTER:

Michiel de Looze, PhD, Senior Scientist, TNO (Netherlands Institute for Applied Research)

Dr. Michiel de Looze, PhD, Senior Scientist at TNO (Netherlands Institute for Applied Research), is involved in research and innovation in close collaboration with industry. His focus is on collaborative robots and exoskeletons. His research gives input to their design and implementation, mainly in the manufacturing, logistics and construction sector. In field and laboratory studies he evaluates their usability and acceptance, and their effects on physical loading, cognitive loading, fatigue and performance. For his work on exoskeletons see TNO iBotics Exoskeletons – YouTube.

IMPULSE TALK PRESENTERS:

Israel Benavides, Program Ergonomist, Ford of Europe

Israel Benavides is a Program Ergonomist with the Ergo team at VOME (Vehicle Operations Manufacturing Engineering), Ford of Europe. In the role he monitors the design, development, and manufacturing of new vehicles to meet the Ford Ergonomics Global Standards. Since 2017 he has participated in Exoskeleton line trials, analysing 14 different models (4 for back and 10 for shoulders) during Ergonomic support at Ford Valencia plant in Spain. This has been in collaboration with the Biomechanical Institute of the Valencia University and the Hamburg University. In 2018 Israel earned the Spanish National Prevention Award ASEPEYO for investigations on exoskeletons. He has presented at several conferences and exoskeleton events in Spain and Germany. In 1990 he received his Nuclear Engineer with Master of Sciences degree from the Moscow Energetic Institute.

Dr. Klaus Bengler, PhD, Chair of Ergonomics, TUM Department of Mechanical Engineering, Technical University of Munich

Klaus Bengler graduated in psychology at the University of Regensburg in 1991 and received his PhD in 1995 in cooperation with BMW at the Institute of Psychology. After his PhD he was active on topics of software ergonomics and evaluation of human-machine interfaces. In 1997 he joined BMW where he was responsible for the HMI project of the MOTIV program, a national follow on the program of PROMETHEUS. Within BMW Research and Technology he was responsible for projects on HMI research and leader of the usability lab. Since May 2009 he is head of the Institute of Ergonomics at Technische Universität München which is active in research areas such as digital human modeling, human robot cooperation, driver assistance HMI and human reliability. He is leading the German Standardization Group (FAKRA) AK-10 “Mensch als Fahrzeugführer” and is an active member of ISO TC22 SC13 WG8 “Road vehicles - Ergonomic aspects of transport information and control systems” as well as member of VDI working group “Menschliche Zuver-

lässigkeit." He is a member of the working group Research of the Round Table Automated Driving (BMVI) and is project leader of the project column Human Factors in Traffic in the German Research Initiative UR:BAN funded by BMWi.

Dr. Ralph Hensel, Industrial Engineer and Ergonomist, Audi

As an Industrial Engineer and Ergonomist at Audi's headquarters in Ingolstadt, Germany, Dr. Ralph Hensel is responsible for testing, piloting and implementing occupational exoskeletons for industrial applications in production and logistics. In the light of his academic background in work physiology, he is strongly involved in research in close collaboration with scientific institutes. In combined field and lab studies, he evaluates usability and acceptance of exoskeletons, their effects on workload relief and load redistribution as well as fatigue and performance, giving input to their further development and implementation in industrial practice.

Jesús Ortiz, PhD, Lead, Wearable Robots, Exoskeletons and Exosuits Laboratory (XoLab), Istituto Italiano di Tecnologia (IIT)

Jesús Ortiz earned his PhD in New Automobile Technologies, University of Zaragoza (2008). He worked as a researcher in the Area of Transports and in the Area of Mechanics in the Department of Mechanical Engineering at the University of Zaragoza. In 2004 he was a guest professor at the "ENSI de Bourges." Since 2006 he has worked at the Istituto Italiano di Tecnologia (IIT) and he is currently the leader of the Wearable Robots, Exoskeletons and Exosuits Laboratory (XoLab) at the department of Advanced Robotics (ADVR). His principal research field is industrial exoskeletons and soft wearable assistive devices. Previous research experience includes motion bases, driving simulators, teleoperation, telepresence, teleexistence, virtual reality, GPGPU computing and medical robotics. He has participated in six European Projects, being the coordinator of the XoSoft EU Project, and in more than 10 international and national projects, including the management of a recent project funded by the Italian Workers Compensation Authority (INAIL). He has over 70 international publications. He has received two awards in 2005 for two different research works about teleoperation and driving simulators, and in CLAWAR, WeRob and CBS conferences for his works on exoskeletons.

Thank You to Our Event Sponsors!

Title Sponsor:

Gold:

Silver:

Bronze:

Event Supporters:

www.wearablerobotics.com