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**MAIN GAP**

# OPERARIO SENSORIZADO Y ROBÓTICA COLABORATIVA

BOLETÍN DE VIGILANCIA TECNOLÓGICA.  
ENERO-MARZO 2020. CTAG



XUNTA  
DE GALICIA



**CEIIA**



Universidade do Minho

## ÍNDICE

**SECCIÓN I. Operario Sensorizado**

**SECCIÓN II. Robótica Colaborativa**

**SECCIÓN III. Eventos Industria 4.0**



## SECCIÓN I. OPERARIO SENSORIZADO

### NOTICIAS

07/02/2020

#### **How Jaguar Land Rover uses VR to design and engineer new vehicles**

Jaguar Land Rover — like its competitors Ford and Mercedes — has been using virtual reality for many years now. At the company's Gaydon Design and Engineering Complex, the team has access to a state-of-the-art virtual reality centre that allows the team to fully visualize the vehicle. According to Richardson, the centre uses eight of the latest generation 4K digital cinema projectors, which deliver four times the resolution of Ultra HD TV, and are driven by 22 of powerful PC computers.



<https://techwireasia.com/2020/02/how-jaguar-land-rover-uses-vr-to-design-and-engineer-new-vehicles/>

19/02/2020

#### **DHL incorpora los primeros exoesqueletos en la fábrica Mercedes-Benz en Vitoria**

DHL Supply Chain Iberia, filial del grupo logístico líder en la gestión integral de la cadena de suministro DHL Supply Chain, ha incorporado los primeros exoesqueletos en la fábrica Mercedes-Benz en Vitoria, con el objetivo de mejorar la ergonomía en aquellos puestos de trabajo con mayor carga física. La iniciativa, que parte del programa Accelerated Digitalization impulsado por DHL para la innovación en las operaciones logísticas, es un proyecto piloto que está actualmente en fase de pruebas de ajuste y adaptación a las nuevas herramientas en distintos procesos de operación de la fábrica.



<https://www.metalindustria.com/noticias/20200219/dhl-incorpora-exoesqueletos-fabrica-mercedes-benz-vitoria#.XlZX6dFYa70>

20/02/2020

#### **Intelligent exoskeleton gets IoT connectivity to join the smart factory**

Developed by German Bionic, the Cray X exoskeleton, which takes the form of a body-worn suit, assists with heavy lifting, using machine learning to learn each user's unique movement style and needs, and adjust as required. However, a partnership with global communications company BICS, announced today, has given the intelligent exoskeleton IoT access for the first time, allowing data from the suit to be transmitted to smart factory and cloud-based management systems. This enables companies running smart factories to monitor and analyse the lifting behaviour of employees, both to keep track of their health and keep track of performance.



<https://www.verdict.co.uk/intelligent-exoskeleton-iot-smart-factory/>



13/03/2020

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### Augmented reality technology assists Volkswagen to remodel Chattanooga production lines

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Engineers at the facility in Tennessee, US, have begun the groundwork for assembling the next generation of Volkswagen electric vehicles planned to begin in 2022 as well as ramping production of the the new Atlas Cross Sport. A new tool, incorporating augmented reality headsets, has helped the team to design production lines through modelling how equipment interacts in the real environment and spotting potential issues. The software tool was developed in-house by the Volkswagen Virtual Engineering Lab.



<https://www.automotivemanufacturingsolutions.com/assembly/augmented-reality-technology-assists-volkswagen-to-remodel-chattanooga-production-lines/40351.article>

13/03/2020

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### La automoción marca el camino de la fábrica conectada

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El sector automovilístico siempre ha estado en el vagón de cabeza de los avances tecnológicos en la industria. No lo iba a ser menos en la digitalización de las plantas. La industria 4.0 aumenta su presencia en las factorías españolas, al mismo tiempo éstas afrontan dos grandes caminos, uno de procesos y otro de producto: el que lleva a la fábrica digital y el que conduce a la movilidad sostenible. En todos ellos, la eficiencia energética está muy presente. En esta nota de prensa, se exponen los proyectos de industria 4.0 de algunos de los principales OEMs de automoción en España (Nissan, SEAT, VW Navarra y PSA España).



<http://www.automaticeinstrumentacion.com/es/notices/2020/03/la-automocion-marca-el-camino-de-la-fabrica-conectada-46287.php>

## PUBLICACIONES CIENTÍFICAS

Enero/2020

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### Features of Human-Exoskeleton Interaction

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*V. Gradetsky, I. Ermolov, M. Knyazkov, E. Semenov, A. Sukhanov*

The operator is an important component of the Operator-Exoskeleton system. He is a source of signals and he controls the result of the motion of the actuators. The main source that drives the links of the human skeleton is the force of muscle contraction. A series of control algorithm tests were carried out to determine the efficiency of the exoskeleton when performing the task of positioning the exoskeleton link in different control modes. In the experimental studies, the time spent on the operation to achieve the target position was measured. In the Laboratory of Robotics and Mechatronics of the Ishlinsky Institute for



Problems in Mechanics RAS a physical model of the arm, exoskeleton was made for experimental investigation.

[https://link.springer.com/chapter/10.1007/978-3-030-37841-7\\_7](https://link.springer.com/chapter/10.1007/978-3-030-37841-7_7)

Enero/2020

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### **A survey of industrial augmented reality**

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*Luís Fernando de Souza Cardoso, Flávia Cristina Martins Queiroz Mariano, Ezequiel Roberto Zorzal*

This article aims to evaluate the impact of Augmented Reality (AR) applicability and usefulness on real industrial processes by employing a systematic literature review (SLR). The SLR was performed in five digital libraries to identify articles and reviews concerning the AR applicability from 2012 to 2018. A patent search in Google's patents database was also conducted, for the same period. This paper describes how AR has been applied, which industries are most interested in the technology, how the technology has been developed to meet industry needs, as well as the benefits and challenges of AR. This survey concludes by providing a starting point for companies interested in integrating AR into their processes and proposing future directions for AR developers and researchers.

<https://www.sciencedirect.com/science/article/pii/S036083521930628X>

Febrero/2020

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### **Methodology of Employing Exoskeleton Technology in Manufacturing by Considering Time-Related and Ergonomics Influences**

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*Christian Dahmen, Carmen Constantinescu*

This article presents a holistic methodology for planning, optimization and integration of exoskeletons for human-centered workplaces, with a focus on the automotive industry. Parts of current and future challenges in this industry (i.e., need of flexible manufacturing but as well having demographic change) are the motivation for this article. This challenges should be transformed in positive effectiveness by integrating of exoskeletons regarding this article. Already published research work from authors are combined in a form of summary, to get all relevant knowledge, and especially results, in a coherent and final context. This article gives interested newcomers, as well as experienced users, planners and researchers, in exoskeleton technology an overview and guideline of all relevant parts: from absolute basics beginning until operative usage.

<https://www.mdpi.com/2076-3417/10/5/1591>



## SECCIÓN II. ROBÓTICA COLABORATIVA

### NOTICIAS

13/01/2020

#### Doosan Robotics presenta la nueva serie Cobot A

Doosan Robotics, empresa coreana fundada en 2015 presentó cuatro nuevos modelos de la serie A (A0509, A0509s, A0912 y A0912s), los cuales se caracterizan por su alta velocidad y aceleración. Con el lanzamiento de la serie A, Doosan Robotics ahora tiene la mayor línea de cobot en la industria, junto con la serie M existente. Doosan Robotics presentó varios procesos aplicados a procesos industriales reales. Por ejemplo, cinco cobots ensamblaron un dron junto a un operario.



<https://www.infopl.net/noticias/item/107349-doosan-robotics-nueva-serie-cobot-a>

04/02/2020

#### Techman Robot presenta su COBOT con visión IA

Techman Robot presentó en la feria iREX (Exposición Internacional de Robots) en Japón sus nuevas tecnologías para la fabricación inteligente. Desde la colaboración humano-computadora en la línea de producción, hasta una solución rápida para la paletización inteligente, y también la integración de AI con visión que mejora enormemente la eficiencia de la inspección. El sistema de visión incorporado en TM Robot también se puede integrar con luz, cámara industrial y sensor para capturar imágenes más precisas. El método deep learning de IA también se utiliza para identificar con precisión la forma, el tipo y el color de un objeto, para mejorar aún más la eficiencia de inspección y mejorar la producción automatizada.



<https://www.infopl.net/noticias/item/107448-techamn-robot-cobot-vision-ia>

18/02/2020

#### El robot colaborativo COBOTTA de Denso recibe el German Design Award 2020

En los German Design Awards 2020, se otorgaron premios en las tres categorías principales "Excelente diseño de producto", "Excelente diseño de comunicaciones" y "Excelente arquitectura". El jurado otorgó al diseño de COBOTTA, que presenta un brazo liviano sin bordes afilados, una aplicación mínima posible de fuerza y presión (gracias a la tecnología de manejo desarrollada adecuadamente) y una velocidad adaptada a la colaboración robot-humano (100 - máx. De 1,000 mm / seg), así como la "seguridad funcional" del robot, que se proporciona al monitorear constantemente el par y las velocidades de todos los ejes.



<https://www.infoplcn.net/noticias/item/107489-robot-colaborativo-cobotta-denso-recibe-german-design-award>

18/02/2020

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### Robótica colaborativa para inspección aeronáutica

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Con el objetivo de optimizar estos procesos, Tekniker, miembro de Basque Research and Technology Alliance (BRTA), ha liderado el proyecto europeo CRO-INSPECT para mejorar la inspección de los alerones del avión, incorporando robótica colaborativa y técnicas avanzadas de ultrasonidos. El proyecto se ha centrado en los requisitos planteados por SAAB, empresa fabricante de componentes de aeronáutica, que ha visto la necesidad de optimizar los procesos de inspección que realizaba hasta la fecha en sus componentes. El proyecto CRO-INSPECT ha tenido como objetivo desarrollar un proceso de inspección no destructiva de componentes aeronáuticos por medio de ultrasonidos controlados por un robot colaborativo embarcado en una plataforma móvil.



<https://www.hisparob.es/robotica-colaborativa-para-inspeccion-aeronautica-2/>

17/03/2020

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### Nuevo robot colaborativo HC20 de Yaskawa

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El nuevo robot colaborativo de Yaskawa HC20 tiene una capacidad de carga de 20 kg y un alcance máximo de 1.700 mm. Con una capacidad de carga de 20 kg, puede manipular tanto piezas grandes como múltiples piezas simultáneamente. Este es uno de sus principales beneficios, ya que, hasta el momento, los robots colaborativos tenían una capacidad de carga menor. Así, Yaskawa hace frente a las necesidades del mercado, donde existe una amplia gama de piezas de hasta 20 kg. Por otra parte, el nuevo HC20 cumple con la norma IEC IEC67, es decir, cuenta con protección antipolvo y a prueba de goteo en todos sus ejes.



<https://www.infoplcn.net/noticias/item/107614-robot-colaborativo-cobot-hc20-yaskawa>

## PUBLICACIONES CIENTÍFICAS

Febrero/2020

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### Human-robot coexistence and interaction in open industrial cells

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*Emanuele Magrini, Federica Ferraguti, Andrea Jacopo Ronga, Fabio Pini, Alessandro De Luca, Francesco Leali*

Recent research results on human–robot interaction and collaborative robotics are leaving behind the traditional paradigm of robots living in a separated space inside safety cages, allowing humans and robot to work together for completing an increasing number of complex industrial tasks. In this context, safety of the human operator is a main concern. In this paper,





we present a framework for ensuring human safety in a robotic cell that allows human-robot coexistence and dependable interaction. The framework is based on a layered control architecture that exploits an effective algorithm for online monitoring of relative human-robot distance using depth sensors.

<https://www.sciencedirect.com/science/article/abs/pii/S0736584518303338>

Febrero/2020

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### Human-Centered Approach for the Design of a Collaborative Robotics Workstation

*Ana Colim, Paula Carneiro, Néelson Costa, Carlos Faria, Luís Rocha, Nuno Sousa, Márcio Silva, Ana Cristina Braga, Estela Bicho, Sérgio Monteiro, Pedro M. Arezes*

Collaborative robotic solutions, where human workers and robots share their skills, are emerging in the industrial context. In order to achieve an appropriate level of Human-Robot Collaboration (HRC), the workstations' design has to be human-centered and adaptive to the workers' characteristics/limitations, considering ergonomic criteria. This study corresponds to the first phase of a research project to apply HRC to minimize the musculoskeletal risk associated with a manual assembly task (industrial furniture manufacturing). A new workstation was designed, and an ergonomic approach was developed to assess the main risk factors, as well as to optimize the future task allocation between human workers and robots. A questionnaire about working conditions and musculoskeletal symptomology was applied to a selected group of 8 workers. Rapid Upper Limb Assessment and Strain Index were applied (across 38 postures) to assess musculoskeletal risk related to the assembly tasks. In this study, we propose an ergonomic approach to orient the design and task allocation of HRC work systems.

[https://link.springer.com/chapter/10.1007/978-3-030-41486-3\\_41](https://link.springer.com/chapter/10.1007/978-3-030-41486-3_41)

Marzo/2020

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### Dynamic risk assessment and active response strategy for industrial human-robot collaboration

*Zhihao Liu, Xinran Wang, Yijie Cai, Wenjun Xu, Quan Liu, Zude Zhou, Duc Truong Pham*

To enhance flexibility and sustainability, human-robot collaboration is becoming a major feature of next-generation robots. The safety assessment strategy is the first and crucial issue that needs to be considered due to the removal of the safety barrier. This paper determined the set of safety indicators and established an assessment model based on the latest safety-related ISO standards and manufacturing conditions. A dynamic modified SSM (speed and separation monitoring) method is presented for ensuring the safety of human-robot collaboration while maintaining productivity as high as possible. A prototype system including dynamic risk assessment and safe motion control is developed based on the virtual model of the robot and human skeleton point data from the vision sensor. The real-time risk status of the working robot can be known and the risk field around the robot which is visualized in an augmented reality environment so as to ensure safe human-robot collaboration. This system is experimentally validated on a human-robot collaboration cell using an industrial robot with six degrees of freedom.

<https://www.sciencedirect.com/science/article/abs/pii/S036083522030036X>





### SECCIÓN III. EVENTOS INDUSTRIA 4.0



**INTERNET OF MANUFACTURING**  
*11-12 febrero 2020, Munich (Alemania)*

Back for its 5th year, Internet of Manufacturing DE 2020 returns to Munich as the flagship event of the global portfolio! This is Europe's only event designed for Manufacturers looking to reap the rewards of Industry 4.0, adopt and deploy the latest in digital, connected & intelligent solutions such as IoT, Predictive Maintenance, AI, Blockchain, Digital Twin, Additive Manufacturing, Robotics plus and much more. With 60% of the audience representing the Manufacturers, the event provides a platform to position your company as a thought leader, engage with prospective new customers and existing clients and shorten sales cycles.

<https://iom-de.internetofbusiness.com/>



**BOSCH CONNECTED WORLD 2020**  
*19-20 febrero 2020, Berlín (Alemania)*

Bosch Connected World 2020 is the meeting point for experts creating connected products and solutions invented for life. Choose between the conference, the exhibition, the hackathon and the many networking opportunities to create your personalized event. This year's program focuses on how to successfully do business during challenging times and how technology as a disruptive force can help achieve your goals. A carefully selected list of inspiring and expert speakers will share their thoughts and learnings on topics like AI, logistics, manufacturing, mobility, business transformation, technology and climate change and much more.

<https://bosch-connected-world.com/>



**ADVANCED FACTORIES 2020**  
*3-5 marzo 2020, Barcelona (España)*



La cuarta edición de Advanced Factories, de ámbito nacional, tendrá lugar del 3 al 5 de marzo de 2020 y ofrecerá soluciones de fabricación avanzada, principalmente en los sectores propios de la máquina-herramienta, como los de máquinas, herramientas, componentes, accesorios, automatización de procesos y fabricación, metrología y control de calidad. Paralelamente, se va a celebrar el Industry 4.0 Congress, el mayor congreso sobre innovación industrial, así como otros eventos tales como Leadership Summit, Talent Marketplace, CIO's Summit o Factory Innovation Theatre entre otros.

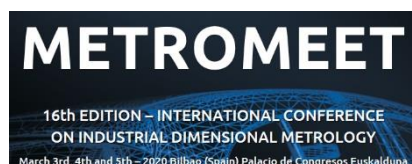
<https://www.advancedfactories.com/>



**EUROPEAN ROBOTICS FORUM**  
*3-5 marzo 2020, Málaga (España)*

The European Robotics Forum, the most influential meeting of the robotics community in Europe, will be held in Malaga, Spain, on 3-5 March 2020, at the Trade Fairs and Congress Center of Malaga (FYCMA). Over 1000 European robotics top experts are expected to attend the 11th edition of the conference. ERF2020 will host a major exhibition where companies, universities and research institutes showcase the most advanced European prototypes, products, services and projects funded under EU's Horizon 2020 research programme.

[https://www.eu-robotics.net/robotics\\_forum/](https://www.eu-robotics.net/robotics_forum/)



**METROMEET 2020**  
*3-5 marzo 2020, Bilbao (España)*

Metromet manages to gather the main company's executives with greater international projection such as Innovalia Metrology, Autodesk, General Electric, Capvidia, Tekniker, Novo Nordisk, or Topsolid. Also, responsible from the most important institutions such as the PTB, the University of Nottingham and Antwerp or the University of the Basque Country. In the 16th Edition of Metromet you will enjoy a third day focused on the Metrology of the future thanks to which we will talk about Digital twins, Artificial Intelligence, Augmented Reality and Management of large amounts of data.

<https://metromet.org/>

