

# MATE Exoskeleton

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# Product Presentation

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## Work-related Musculoskeletal Disorders (WRMSDs)



World Health Organization- Data on Musculoskeletan Conditions - <u>https://www.who.int/news-room/fact-sheets/detail/musculoskeletal-conditions</u>
The Impact of Musculoskeletal Disorders on Americans — Opportunities for Action <u>http://www.boneandjointburden.org/docs/BMUSExecutiveSummary2016.pdf</u>
Estimated value from http://www.hse.gov.uk/statistics/causdis/msd.pdf

## Case Study : Cost to Employers of WRMSDs in UK



http://www.hse.gov.uk/statistics/adhoc-analysis/esau-costs-to-britain-supplementary.pdf?pdf=esau-costs-to-britain-supplementary

\* Considering 170,000 workers

## Current Solutions-Tackling MSDs means taking actions in the workplace





# Hypothesis driven product Design



## MATE works just the way you do



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## **Multi-Competence Collaborations**



Soft Robotics Neuro robotics

Sensor signal and information processing Translational neural engineering Surgical robotics Artificial Hands

Experts on Wearable and exclusive IP licensing



COMAU

World leader in the field of industrial automation

Lean Manufacturing Humanufacturin approach Engineering and Industrialization



Mission: improve people mobility

Founded in 1971 in Iceland

+ 3000 employee

# ÖSSUR

world market technology leader of non-invasive orthopaedic equipment



**₽**ÖSSUR 1

## Development Process-From workers to workers: a bottom-up approach





## What is MATE?

#### MATE is is an upper-limb exoskeleton totally passive (w/o motors). MATE is designed to assist the user during flexo-extension movements of the shoulder.

## **1** Garment interface

All parts in direct contact with the user's body

### 2 Mechanical shoulder chain

Structure that facilitate the free movement of the user, such as sliding and rotational joints

## **3 Torque generator box**

Core mechanism that store and transform potential mechanical energy of order to create an adjustable assistive torque (**7 levels**)



## How does it work



Generation of an assistance proportional to the torque generated by the upper-limb weight during shoulder flexion/extension movements:

- Zero torque at elevation angle 0°
- Max torque at elevation angle 90°
- No discontinuities during elevation
- Possibility of tuning the amount of assistance

The device reproduces all the **passive degrees of freedom** at the shoulder allowing the arm to perform its physiological movements such as:

- Abduction- adduction (sagittal plane)
- Flexion-extension (coronal plane)
- Rotational (transverse plane)



## How MATE will help your business



(1) «Passive Upper Limb Exoskeletons: an Experimental Campaign with Workers», Stefania Spada (FCA), Lidia Ghibaudo (FCA), Chiara Carnazzo (FCA), Laura Gastaldi Maria Pia Cavatorta. (2) Estimated KPI from (1)

(3) IEEE Robotics and Automation Magazine, 2019, Pacifico et al., under review

## FCA Studies<sup>(1)</sup>



(1) Passive Upper Limb Exoskeletons: an Experimental Campaign with Workers, Stefania Spada (FCA), Lidia Ghibaudo (FCA), Chiara Carnazzo (FCA), Laura Gastaldi Maria Pia Cavatorta. (2) Estimated KPI from (1)

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# **Clinical Studies**<sup>(1)</sup>

CONGREGAZIONE DELLE SUORE INFERMIERE DELL'ADDOLORATA O S P E D A L E V A L D U C E

- To test upper limb muscle activation in the targeted tasks
- To test whether the device alters the shoulder kinematics

Methodology:

**Objectives** 

- EMG recording by means of BTS FREEMG 1000, 1000 Hz
- Motion tracking by means of BTS (SMART DX 7000) at 250 Hz, 8 cameras

#### Task

- Non-functional movements
- Functional movements



#### **Main Results**



#### Conclusion

- The **device reduces the physical workload** of agonist and antagonist muscles involved in shoulder flexion-extension and abdo-adduction
- The shoulder joint kinematics is not significantly altered by the exoskeleton
- The pHMI is stable and well-coupled with the body segments during the execution of the tasks

(1) IEEE Robotics and Automation Magazine, 2019, Pacifico et al., under review

## **Collaboration with Fondazione Ergo**





MACHINERY	WHITE GOODS	MINING EQUIPMENT		TEXTILE
APPLIANCE	TRAINS	AUTOMOTIVE	AEREOSP	ACE&DEFENCE
Collaboration between		New EAWS Release, including Exo section for Upper Limbs		
fondazionergo .BELLATACTORY.			Jan	2020

https://www.fondazionergo.it/

## Features and Benefits at a glance



## Get in touch with our MATE Specialist team



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## Awards & Recognition





MATE won «Best of Industry Award 2019» from Magazine «MaschinenMarkt».





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