

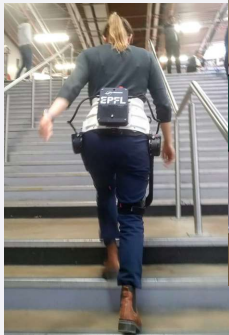
# Robotics for manipulation# Micro 450

Chapter 1- Introduction to Robotics  
Dr Mohamed Bouri

# REHAssist

Rehabilitation and Assistive Robotics, EPFL  
<http://rehasist.epfl.ch>

REHAssist



REHAssist

Industrial Robotics



Rehabilitation Robotics



Surgical Robotics



## Chapter 1- Introduction to Robotics

- Part 0** Explore Applications  
Organisation of the course MICRO 450
  
- Part 1** Definitions and classifications of Industrial robots
  
- Part 2** Numbers and Markets
  
- Part 3** Architectures and geometries of “[Serial Robots](#)”

Chapter 2 will focus on “[Parallel Robots](#)”

# Robotics for Manipulation

Part 0: Introduction and course organization

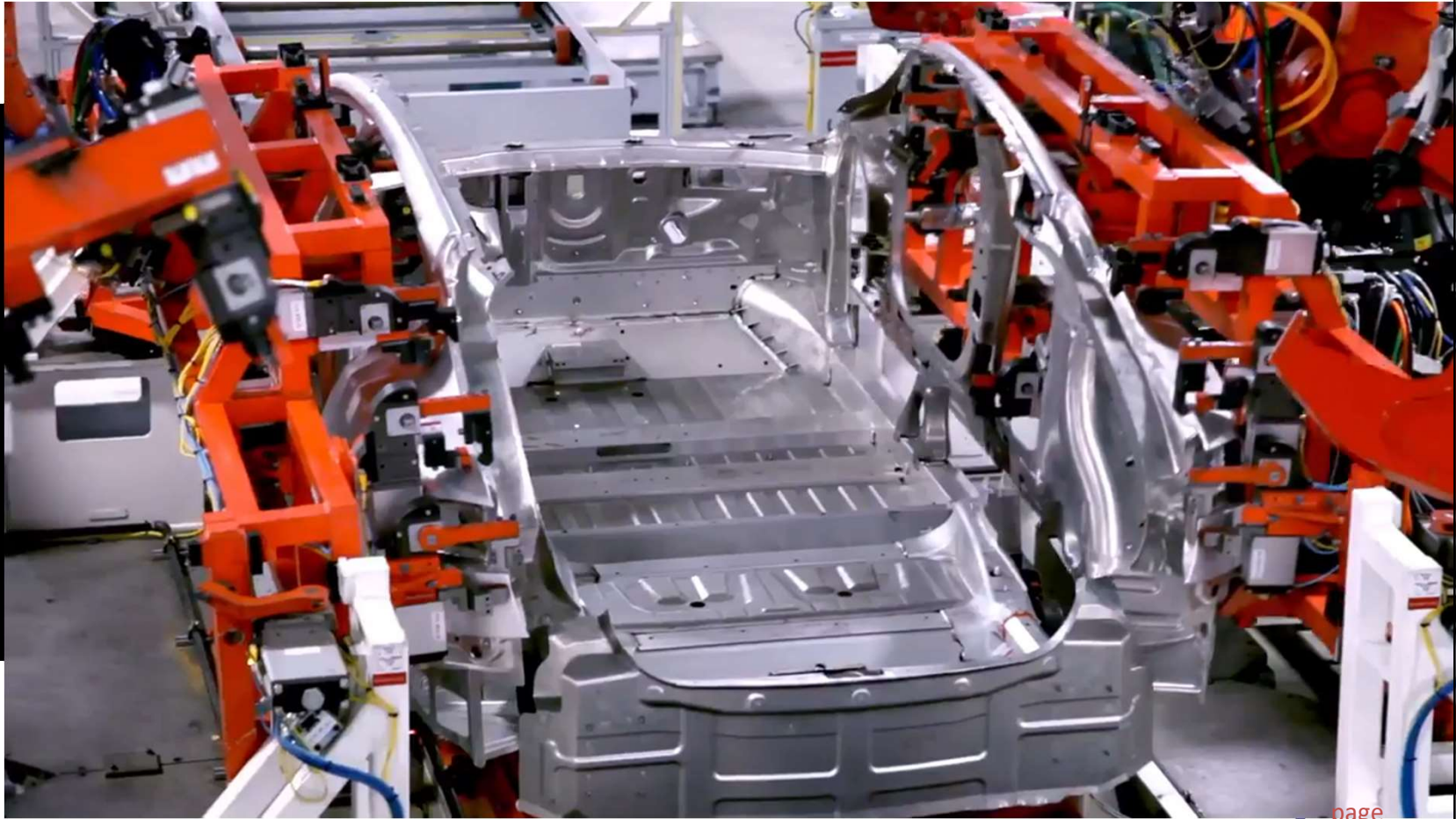


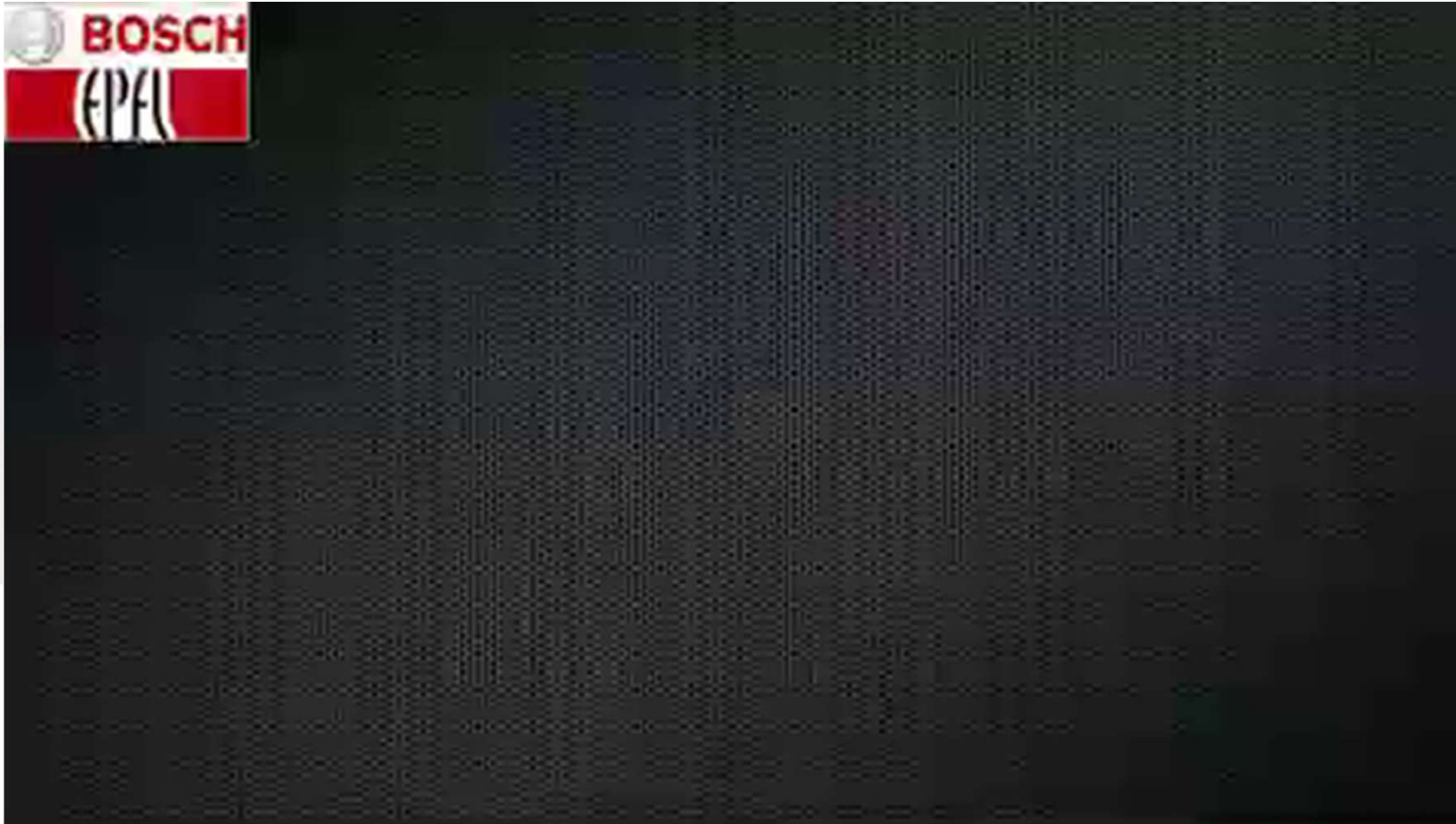
## Explore

Let us explore examples of robotic applications

## Automotive industry

How the Tesla Model S is  
Made  
Credit - Tesla Motors





[Tschudi, ISIR 2012]  
 [Bennahar, IJC 2017]



[Patent 2015] Device For Moving And Positioning An Object In Space, Huser M., Tschudi M., Keiffer D., Teklits A., Bouri M., Clavel R., Demaurex MO., Device For Moving And Positioning An Object In Space, reference WO2012152559

# Food industry- faster !



Acceleration :30 Ge  
Error RMS <0,4 mm

## Surgical robotics



Credit: Intuitive , robot Davinci

# Hand to hand : collaborative robotics

- 10 -



Credit: Universal robotics

# Legged robots

- 11 -



Credit: Boston Dynamics

Credit: ANYbotics

You said legged robots !



# Walk Assisting devices by Honda



## TWIIICE exoskeleton

Developed by the REHAssist group - EPFL

First public showcase,  
on 11.09.2016

Goal:  
Walking assistance for people with spinal cord  
injury-



# Lower Limb Exoskeletons: Tailored Solutions for Mobility & Mobilization Challenges



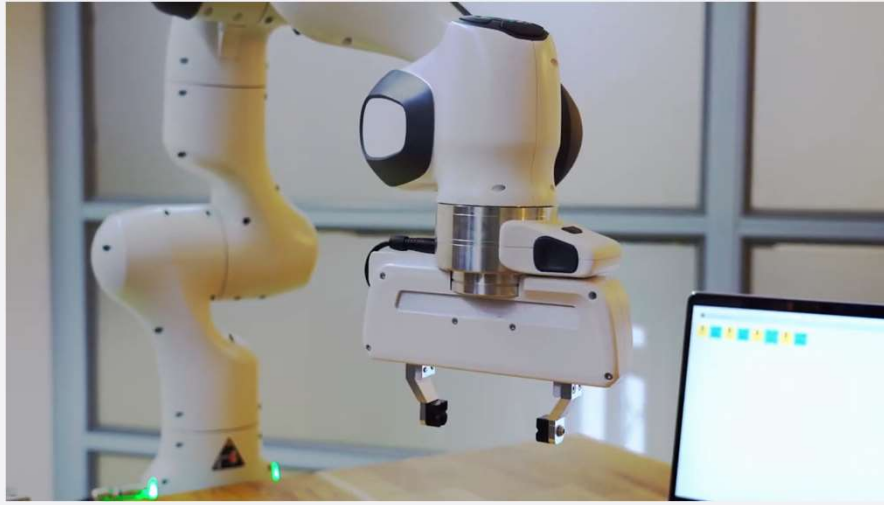
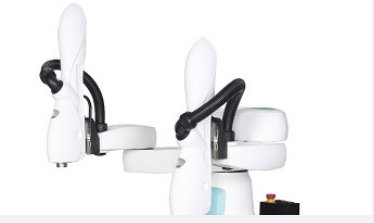
To walk again

To walk better

To walk more

Vouga, [ICORR 2017](#), Baud, [ICORR 2019](#), JNER 2021, Ortlieb, [ICORR 2017](#)  
Fasola, [ICORR 2019](#), Fasola, [Frontiers R & AI, 2020](#), Vouga, [JNER, 2022](#) Olivier J. [Rob & Aut Sys, 2015](#), Baud, [Springer chapter, 2018](#)

## Speaking robotics



Credit: ANYbotics



Credit: Boston Dynamics

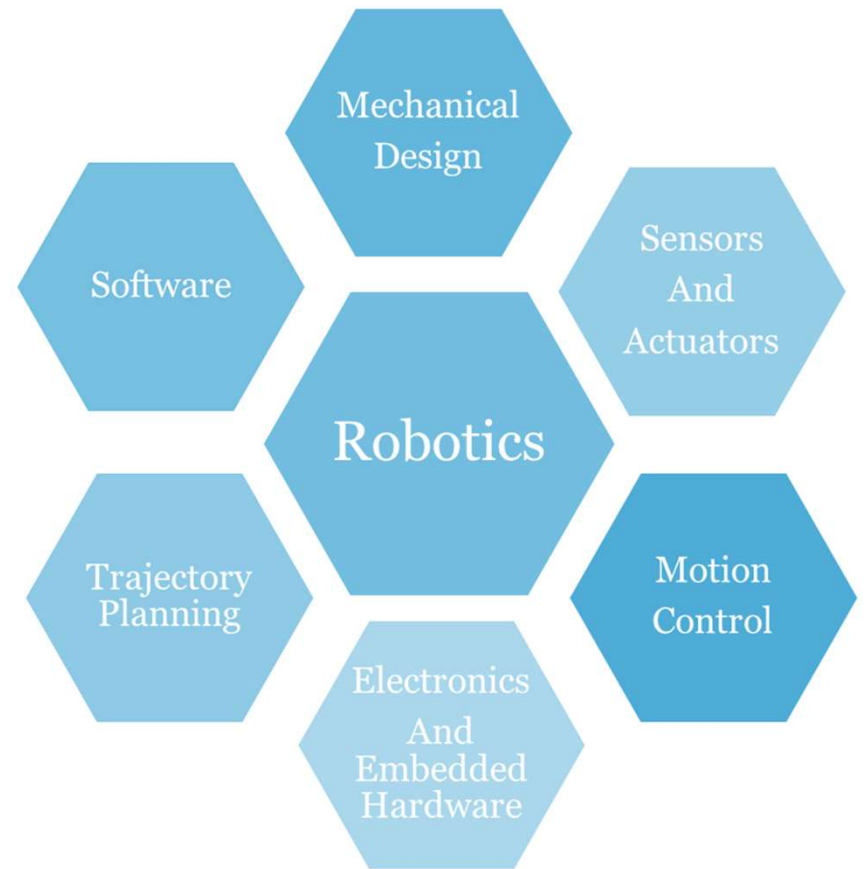


Whatever the purpose, **Robotics is about motion**  
Actuated, controlled, and interaction

*In the late ten years....  
Robotics has been closest to  
**more disciplines***



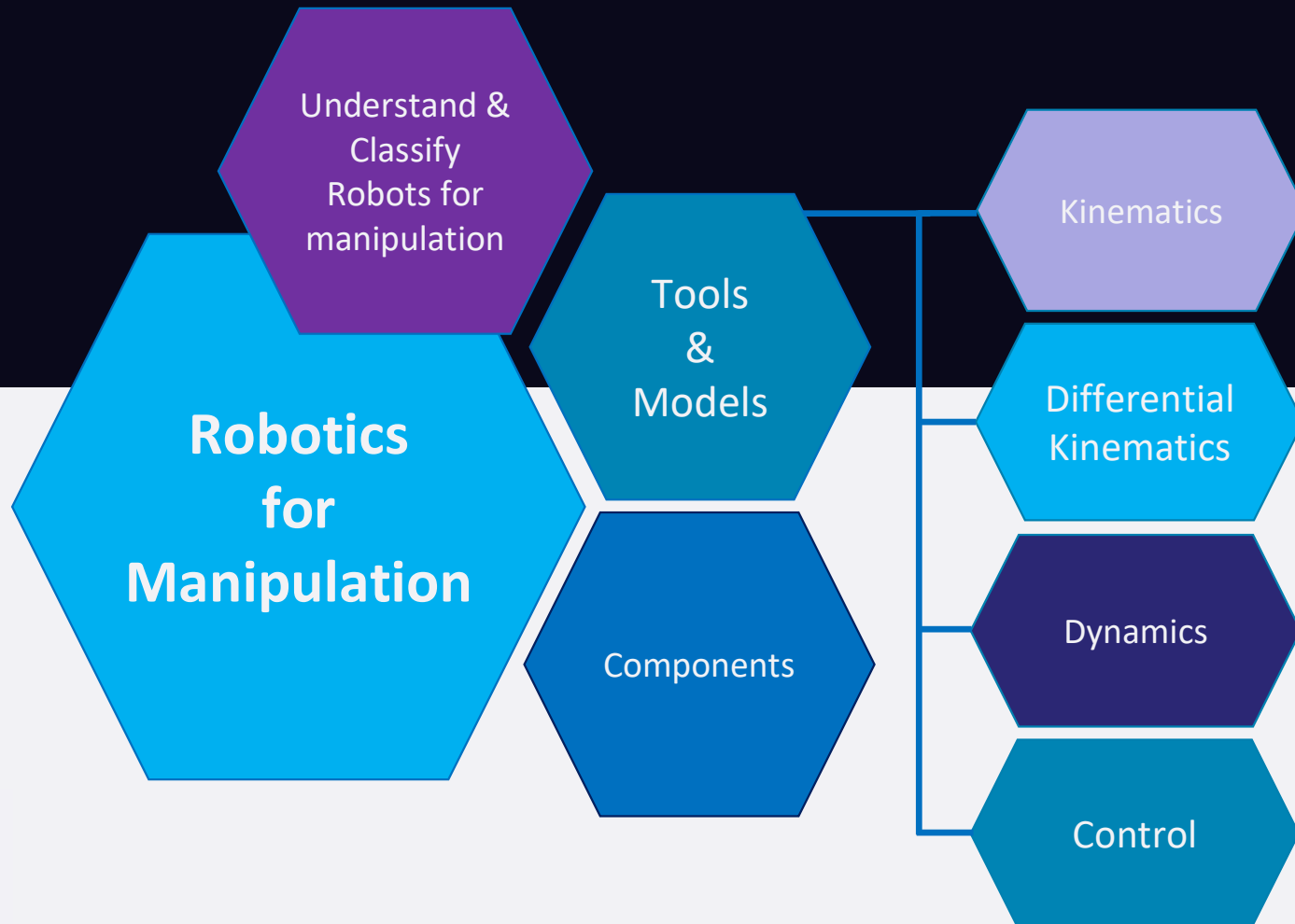
- *Surgery and rehabilitation*
- *Cognitive neurosciences*
- *Gaming*
- *Building manufacturing*
  
- *Education*



**The required skills  
are more and more  
“MULTIDISCIPLINARITY”**

# Course organization

This course is about “Robotics for Manipulation”



# Agenda

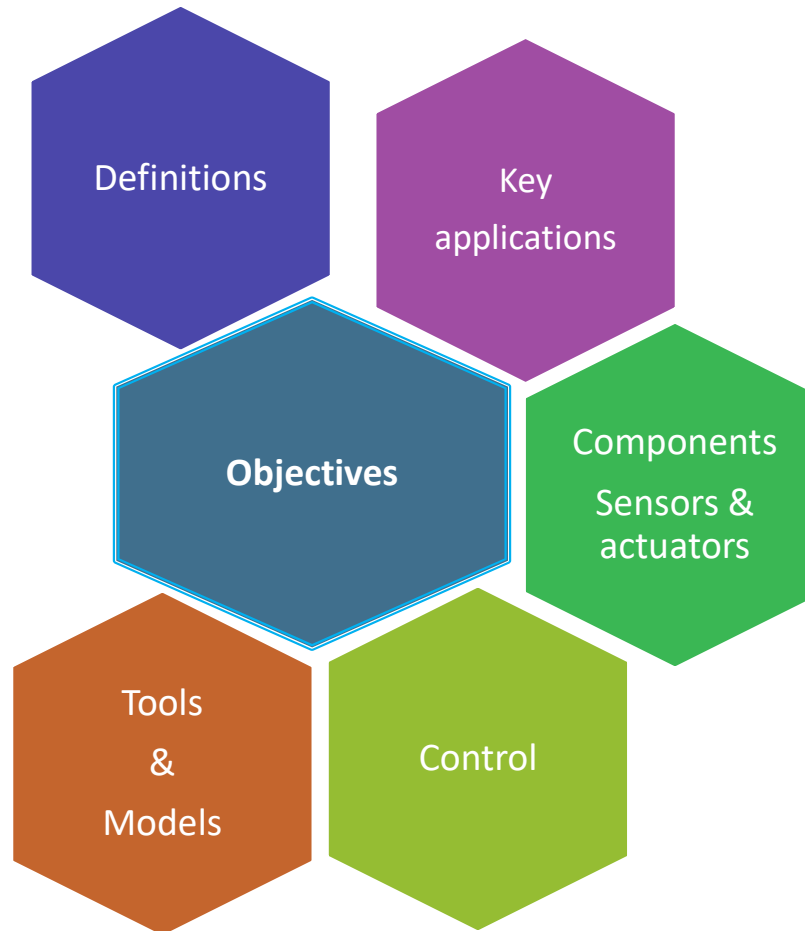
- 19 -

| Wednesday | 10:00-13:00 |   |
|-----------|-------------|---|
| week1     |             | Course organization- Introduction to robotics / serial robotics |
| week2     |             | Parallel robotics   |
| week3     |             | Introduction to aspects of kinematics                           |
| week4     |             | Kinematics 1-   |
| week5     |             | Kinematics 2- / use case study                                  |
| week6     |             | Jacobian / use case study                                       |
| week7     |             | Dynamic modeling 1  |
| week8     |             | Dynamic modeling 2 - Use case study                             |
| week9     |             | Dynamic modeling 3 - Use case study                             |
| week10    |             | Sensors   |
| week11    |             | Actuators   |
| week12    |             | Control   |
| week13    |             | Control   |
| week14    |             | Control – Use case study  |

- Course Map
- Moodle / supports
- Corrected exercises
- Exams on moodle.... Sample exercises

## My objectives with you in this lecture:

- Be aware of **keywords** and **numbers**.
- Know how to **select a robot**
- Aware of all **modelling tools**
- Basics of **robot control**
- **Companies** active in robotics
- **Challenges** of tomorrow  
(We are already tomorrow)



# Robotics for Manipulation

## Part 1: Definitions and classification