



ROBOVIS 2026

6th International Conference on Robotics, Computer Vision and
Intelligent Systems

Marbella, Spain

2 - 4 March, 2026

Robot Manipulation and Control

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University of Naples Federico II

Robotics @ PRISMA Lab

- ✓ 3 Full Profs + 3 Associate Profs + 4 Assistant Profs
- ✓ 13 Post-docs + 14 PhDs + 7 A/T staff
- ✓ 25 EU projects in last 18 years (incl. 2 ERC Grants)
- ✓ Partnership w/ 180 foreign institutions & companies
- ✓ 10 Patents + 35 Awards in last 20 years

✓ Research areas

- ❖ Aerial Robotics
- ❖ AI & Cognitive Robotics
- ❖ Dynamic and Legged Robotics
- ❖ Human–Robot Interaction
- ❖ Industrial Robotics
- ❖ Medical Robotics

✓ Start-ups

- ❖ Neabotics
- ❖ Herobots



Neabotics
— Service Robotics Solutions —

HEROBOTS



<https://prisma.dieti.unina.it>



<https://www.icaros.unina.it>



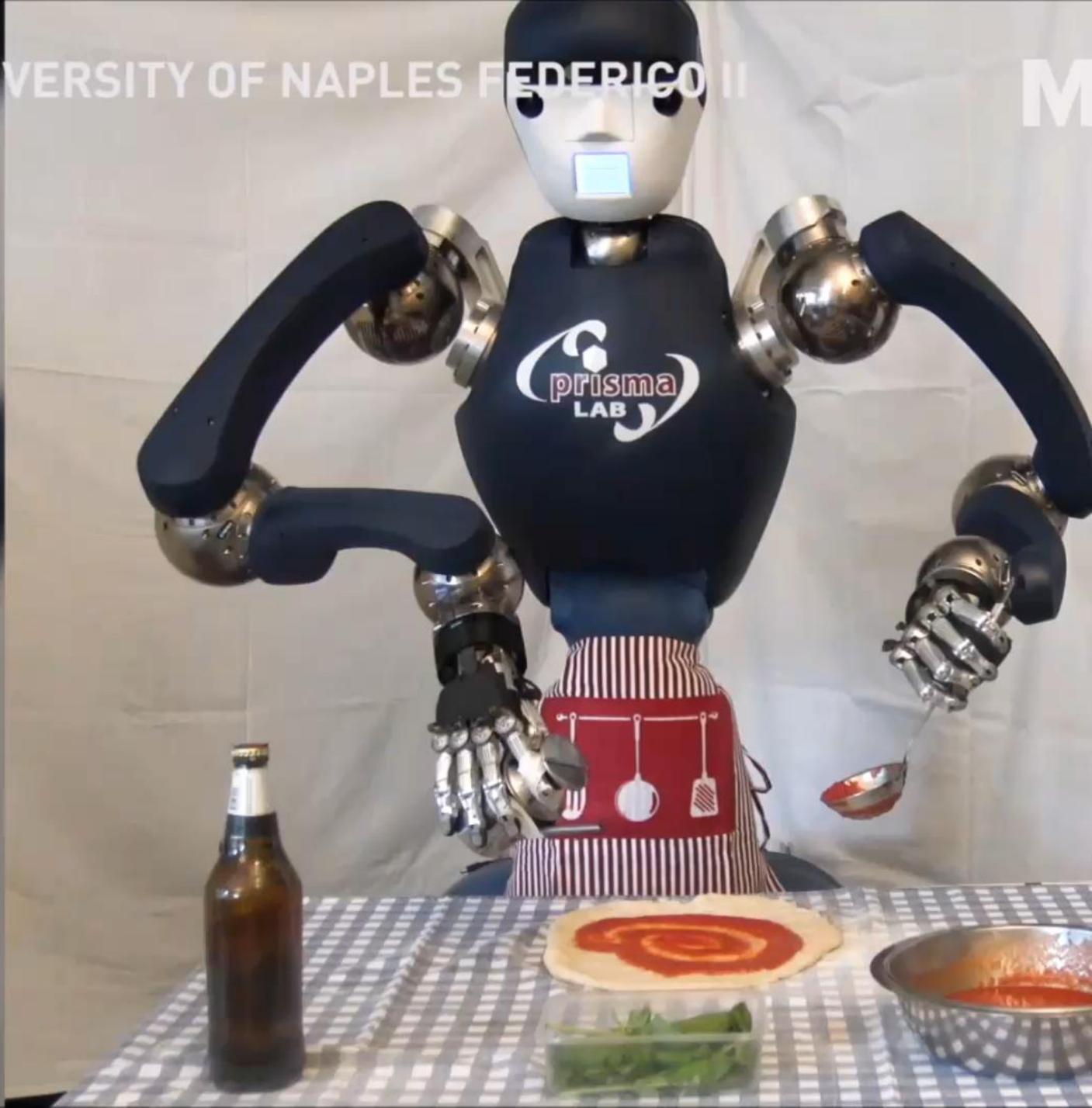
Dynamic Manipulation
Autonomous Manipulation
Aerial Manipulation
Haptic Shared Control

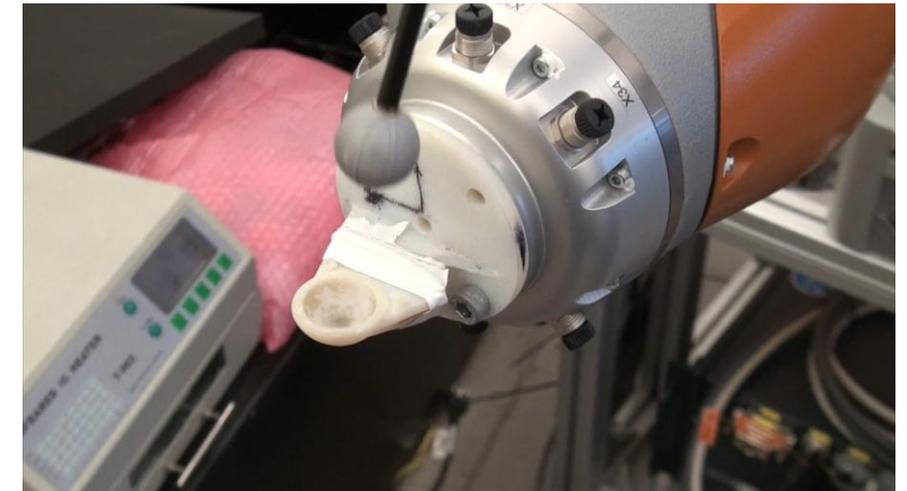
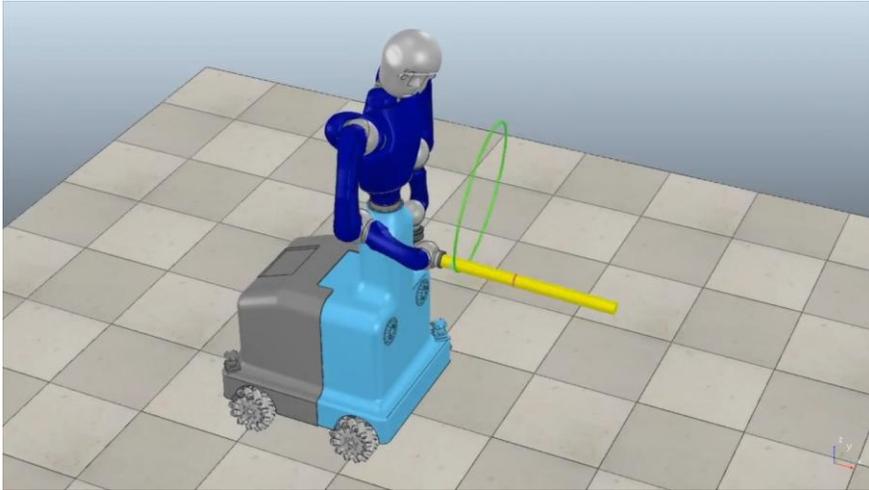


Dynamic Manipulation

PRISMA LAB/UNIVERSITY OF NAPLES FEDERICO II

Mashable



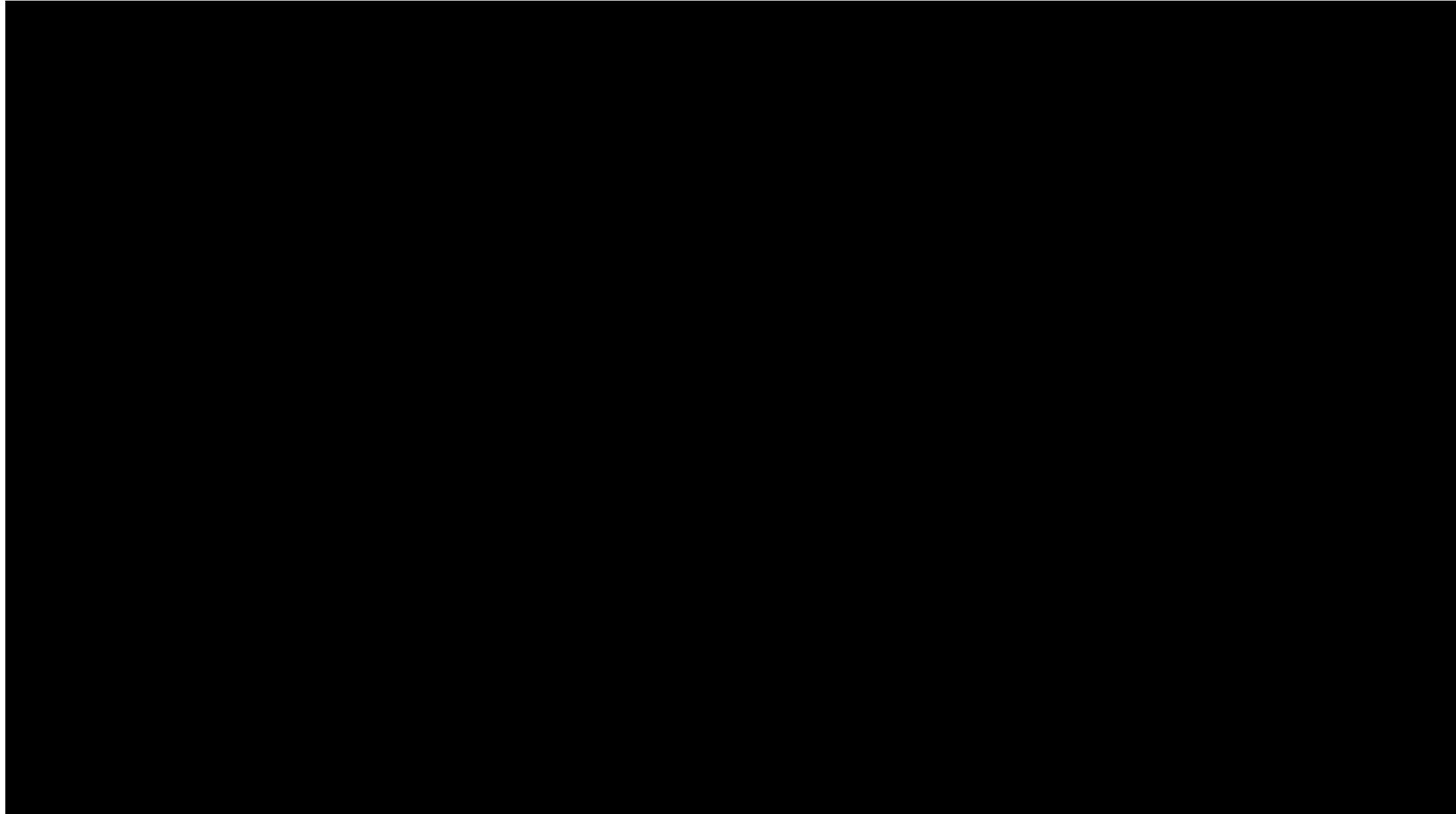


A Coordinate-Free Framework for Robotic Pizza Tossing and Catching

Aykut C. Satici, Fabio Ruggiero, Vincenzo Lippiello, Bruno Siciliano

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- Shared control to enforce **friction constraints**
- Autonomous orientation regulation
- **Haptic guiding** interface
- Human subject study



- Non-prehensile pushing manipulation with **compliant robot**
- Enforcing **passive behavior** w.r.t. external physical interaction
- **Optimization-based** pushing controller
- **Energy tank-based** velocity set-point modulation



Compliant Non-Prehensile Pushing Manipulation

Francesco Cufino, Mario Selvaggio, Fabio Amadio, Fabio Ruggiero

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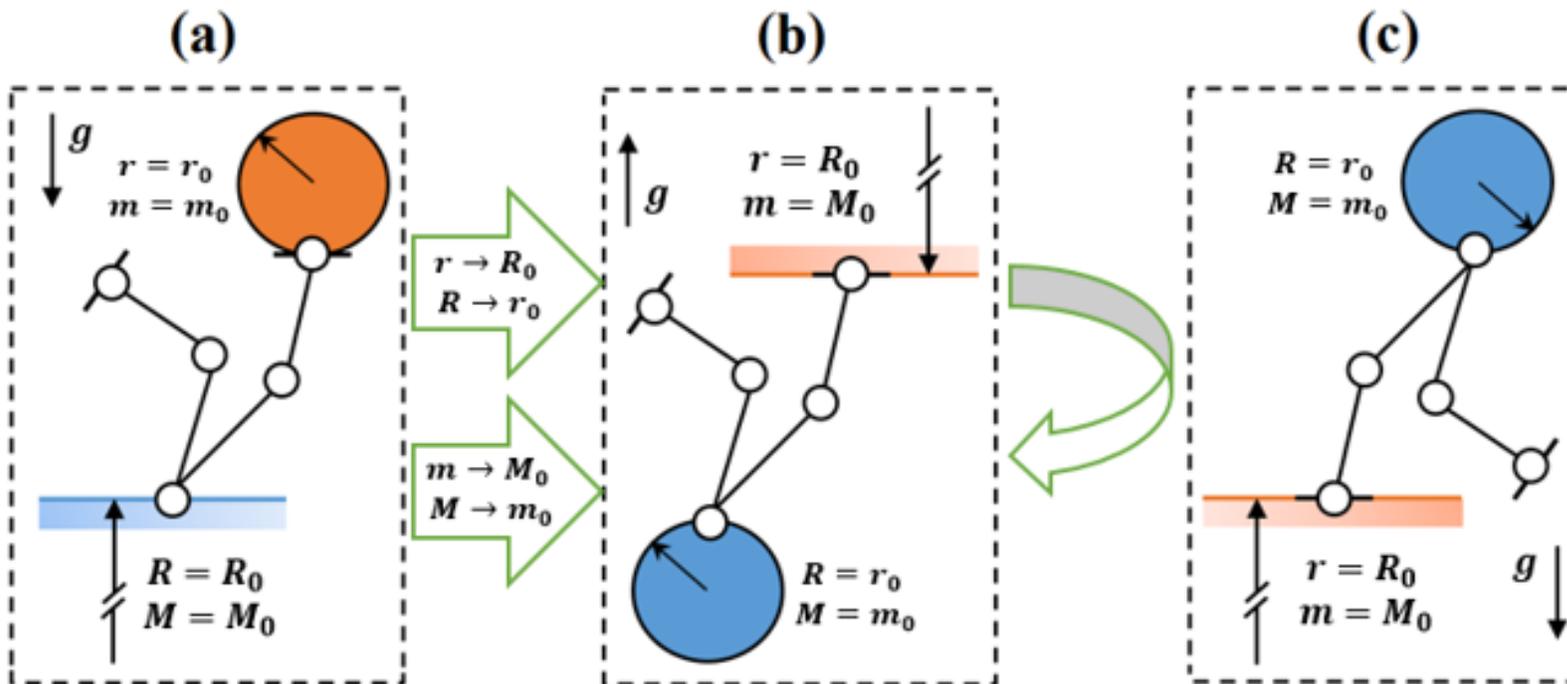
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LARSEN/HUCEBOT team

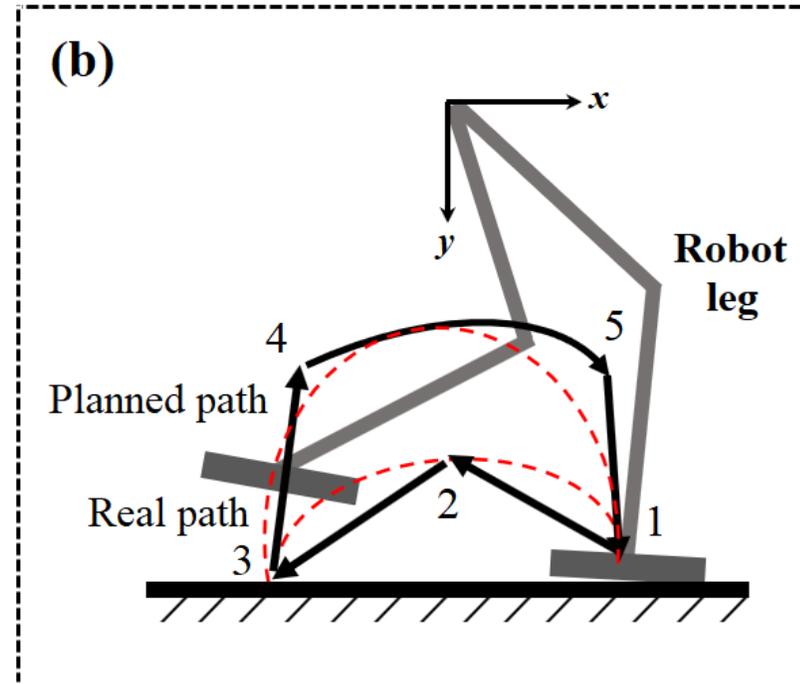
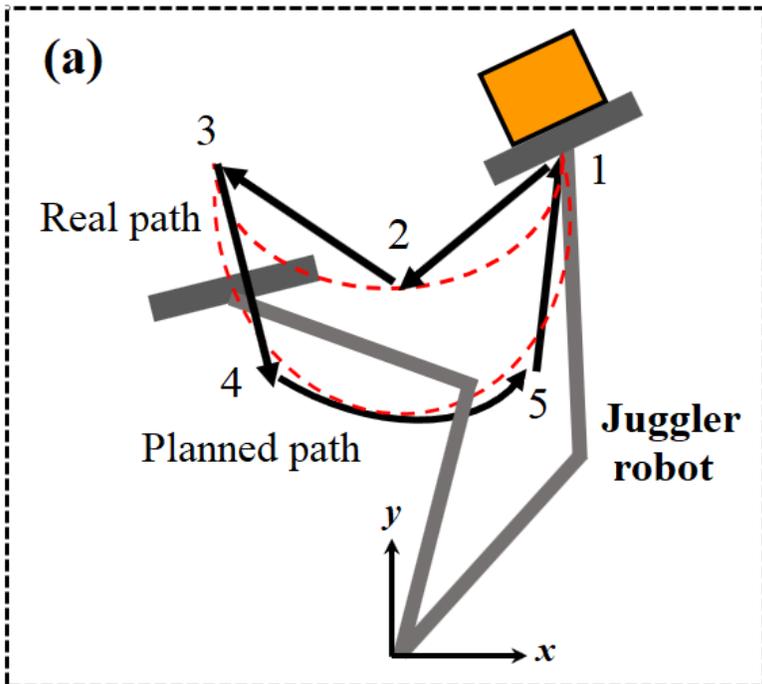
Inria, Université de Lorraine, CNRS, LORIA

ABB Corporate Research Center

- Analogy between non-prehensile manipulation and legged robots
 - Duality between a **multi-fingered grasp** and **multi-legged stance**
 - In **quasi-static walking** imagine the biped instantaneously manipulating the Earth
 - In **quasi-static manipulation** imagine two fingers manipulating a sphere



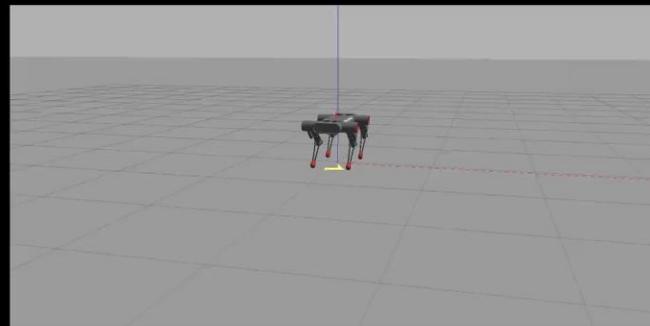
- Connection between manipulation path and locomotion path
 - **Two-link walker** is similar to the corresponding **non-prehensile object manipulation**
 - Stability conditions in the support phase of a **flat-feet biped robot** have a similar structure of dynamic grasp conditions in the carrying phase of a **juggling system**



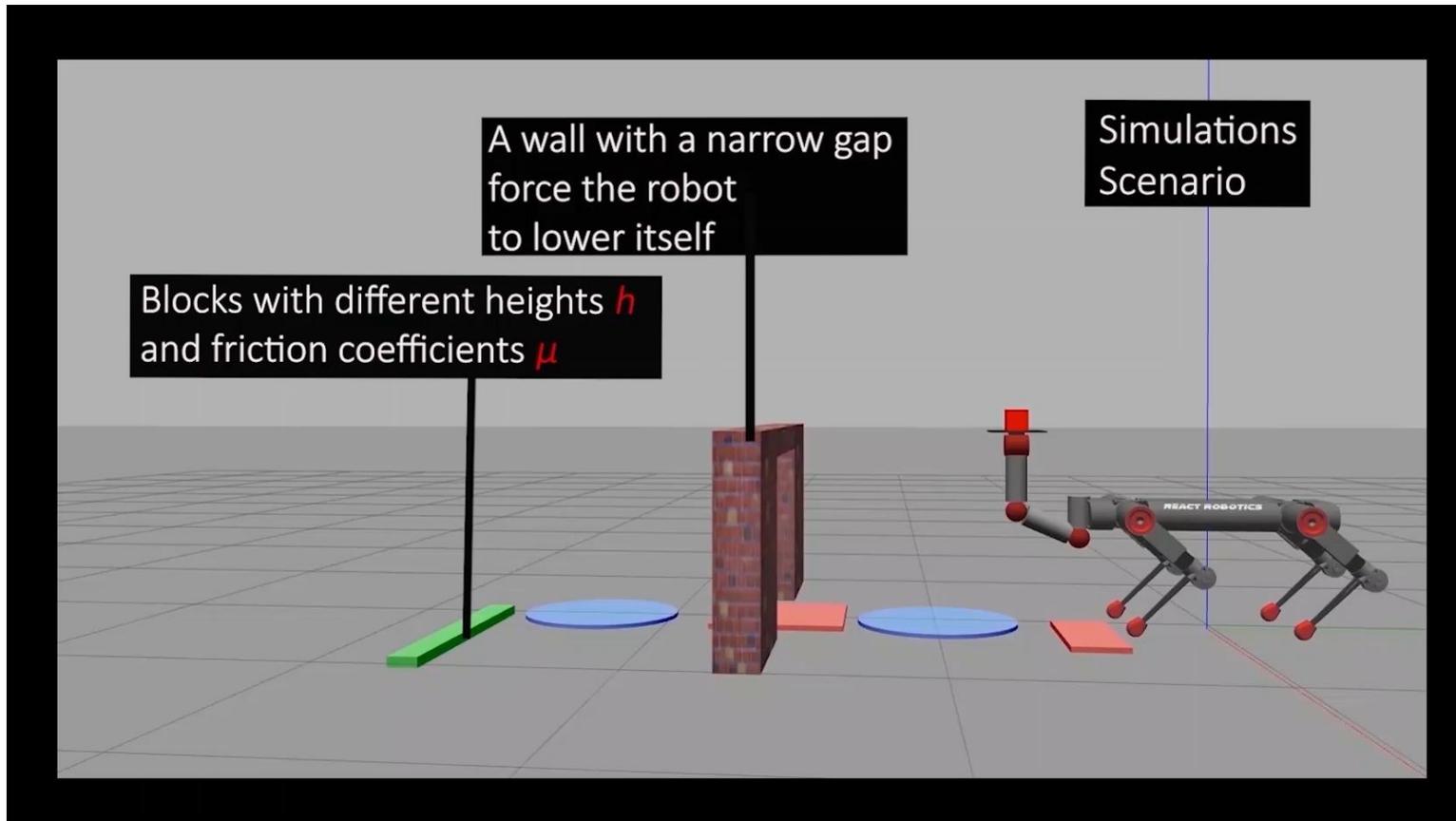
- Gaits robustified by compensating for disturbances acting at both centre of mass and legs
 - Momentum- and acceleration-based observers are combined to use only measured sensory data
 - Both swing and stance legs disturbances are considered

Legged robots need to navigate through challenging environments.

An observer is usually employed to retain the balance when the robot is subject to external disturbances.



- (Non-prehensile) manipulation skills merged while walking
 - Comprehensive **whole-body controller** for both walking and manipulation



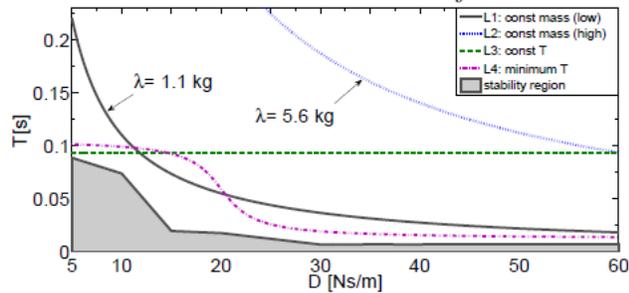


Autonomous Manipulation

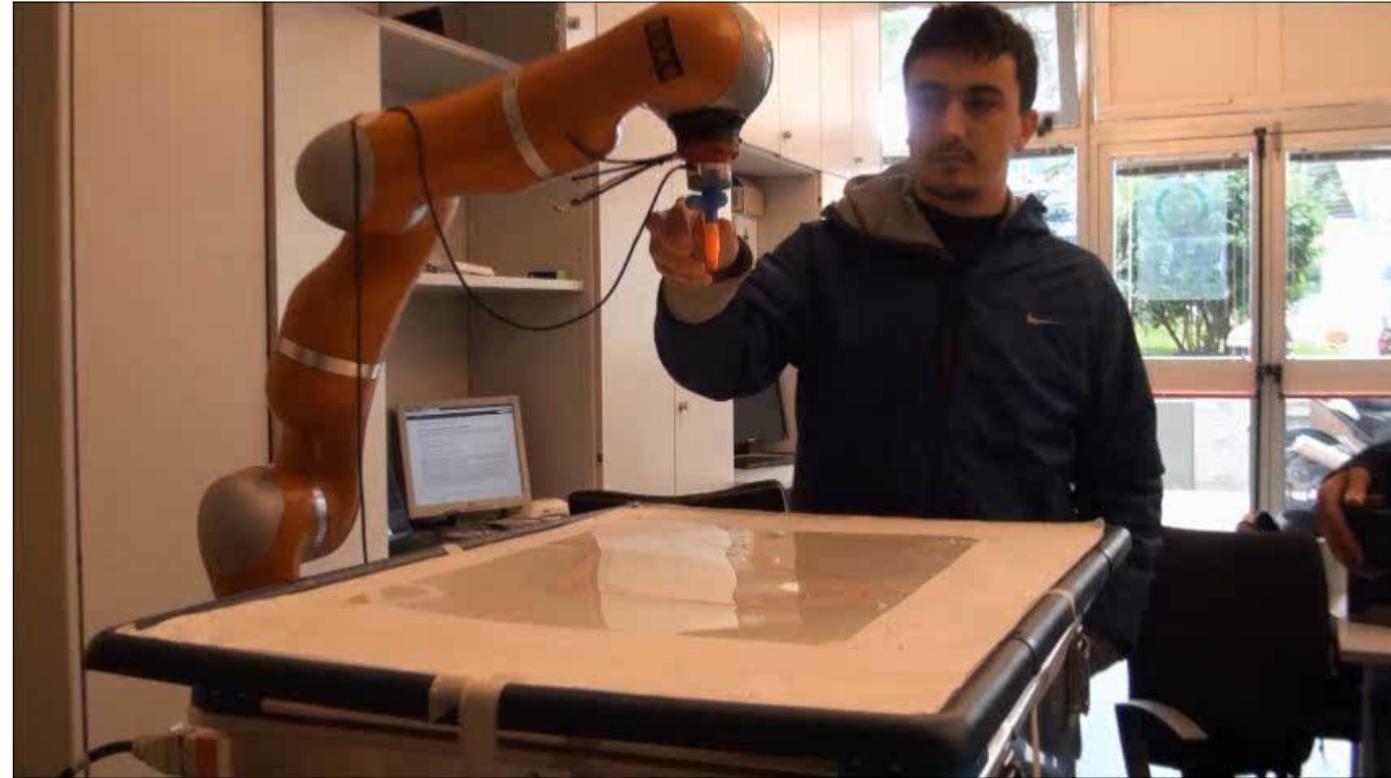
- Variable impedance parameters

$$D = a e^{-b|\dot{x}|}$$

$$\lambda = \lambda_f \frac{D}{D_f} (a + b \arctan(c(D - d)))$$



- L1: constant mass, low value (close to minimum value within stability region)
- L2: constant mass, high value
- L3: constant $T = \lambda D$, set as minimum value within stability region for any damping
- L4: minimum (variable) T within stability region for any damping D



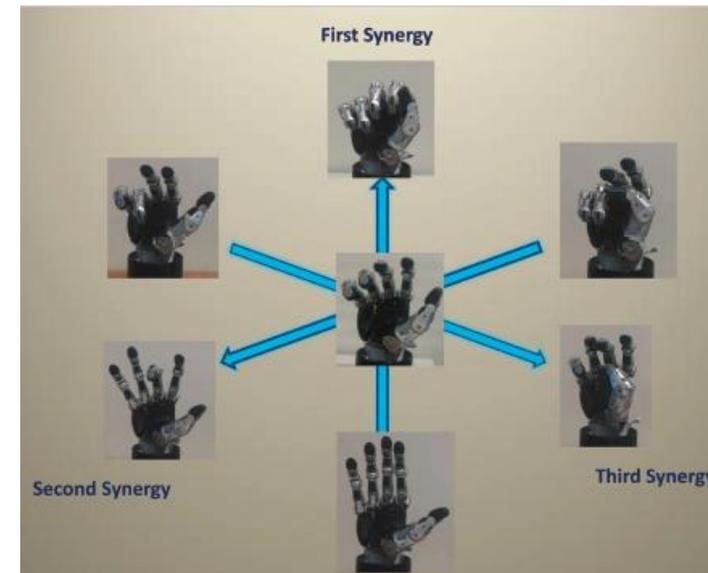
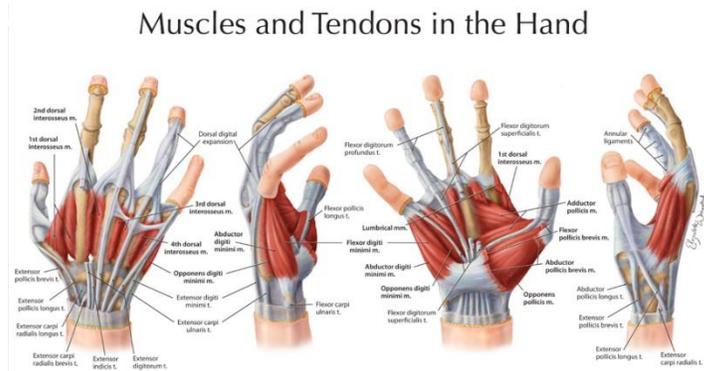
- The concept
 - Tendon couplings and muscle activation patterns lead to movement coordination
- A mathematical framework
 - Mapping from human hand fingertip positions to robotic hand joint positions
 - PCA

- Differential mapping
 - between **Motor Synergies Subspace** and **Cartesian Space**

$$\dot{x} = J_{h_{m_s}} \dot{\sigma}$$

- Synergies Jacobian

$$J_{h_{m_s}} = J_h S_m S_s$$

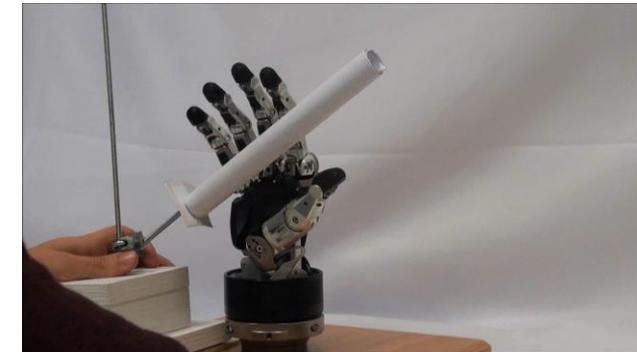
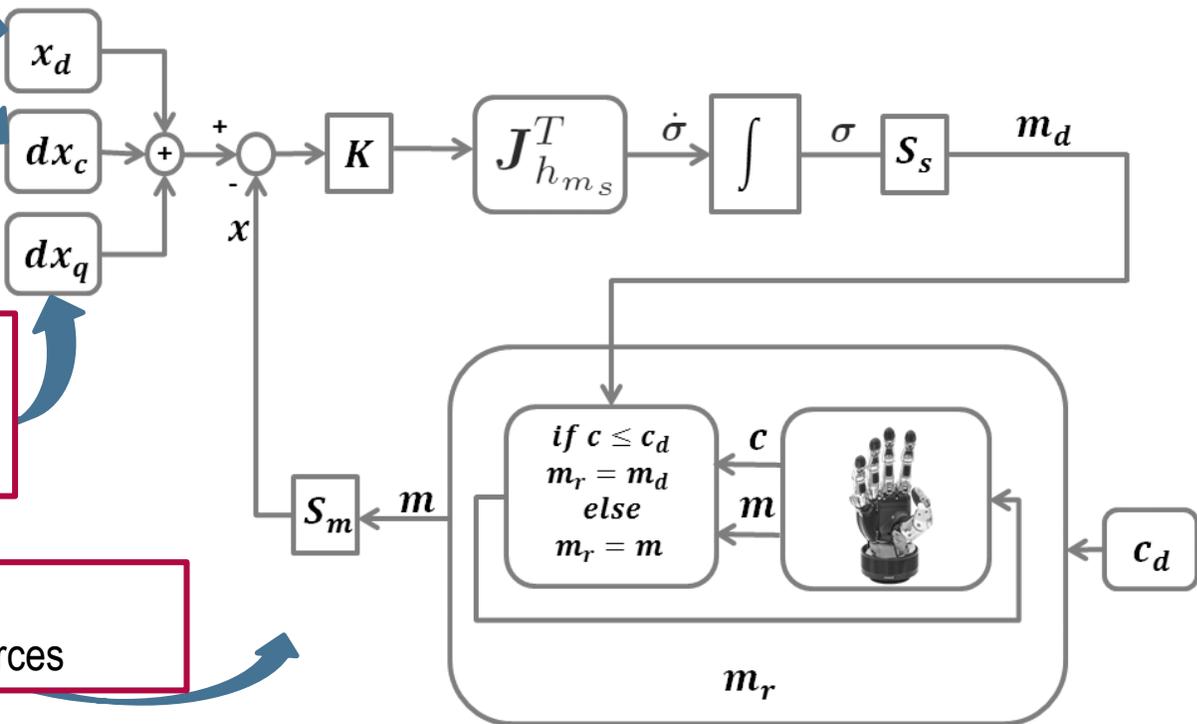


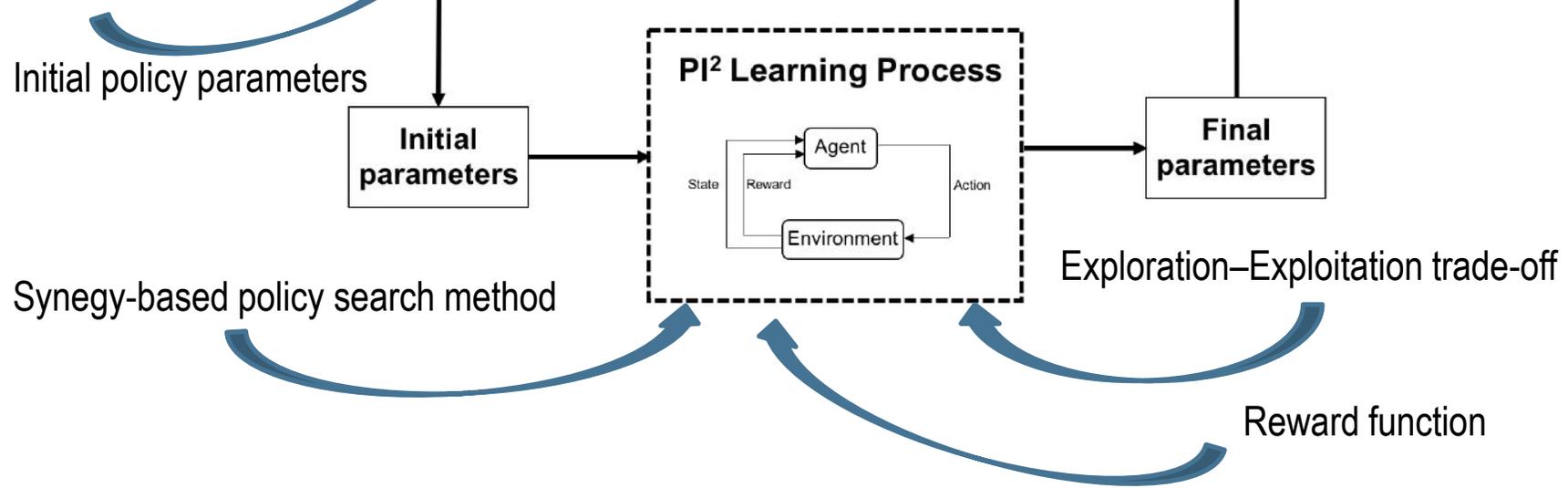
feedforward term for hand pre-shaping
 the configuration selected within the **data-set** used for synergies computation on the basis of the similarities related to the object shape and size, and to the grasp type, namely power, precision or lateral grasp

local adaptation
 realized in a synergy-based framework exploiting force and position feedback

grasp optimization
 synergy-based quality index relying on force closure property

current regulation
 to avoid high contact forces







Robotic Depalletizing Cell



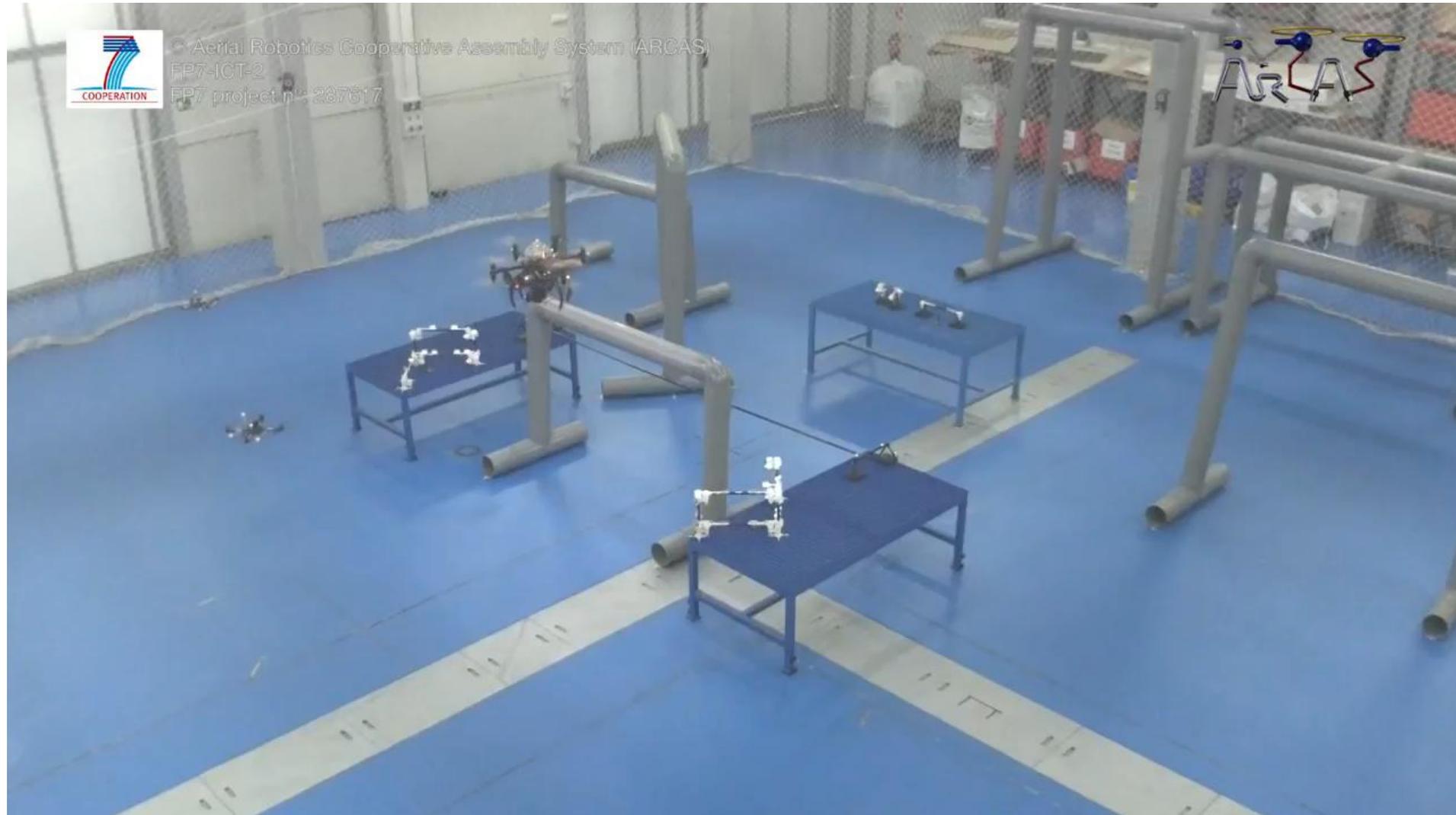


Aerial Manipulation

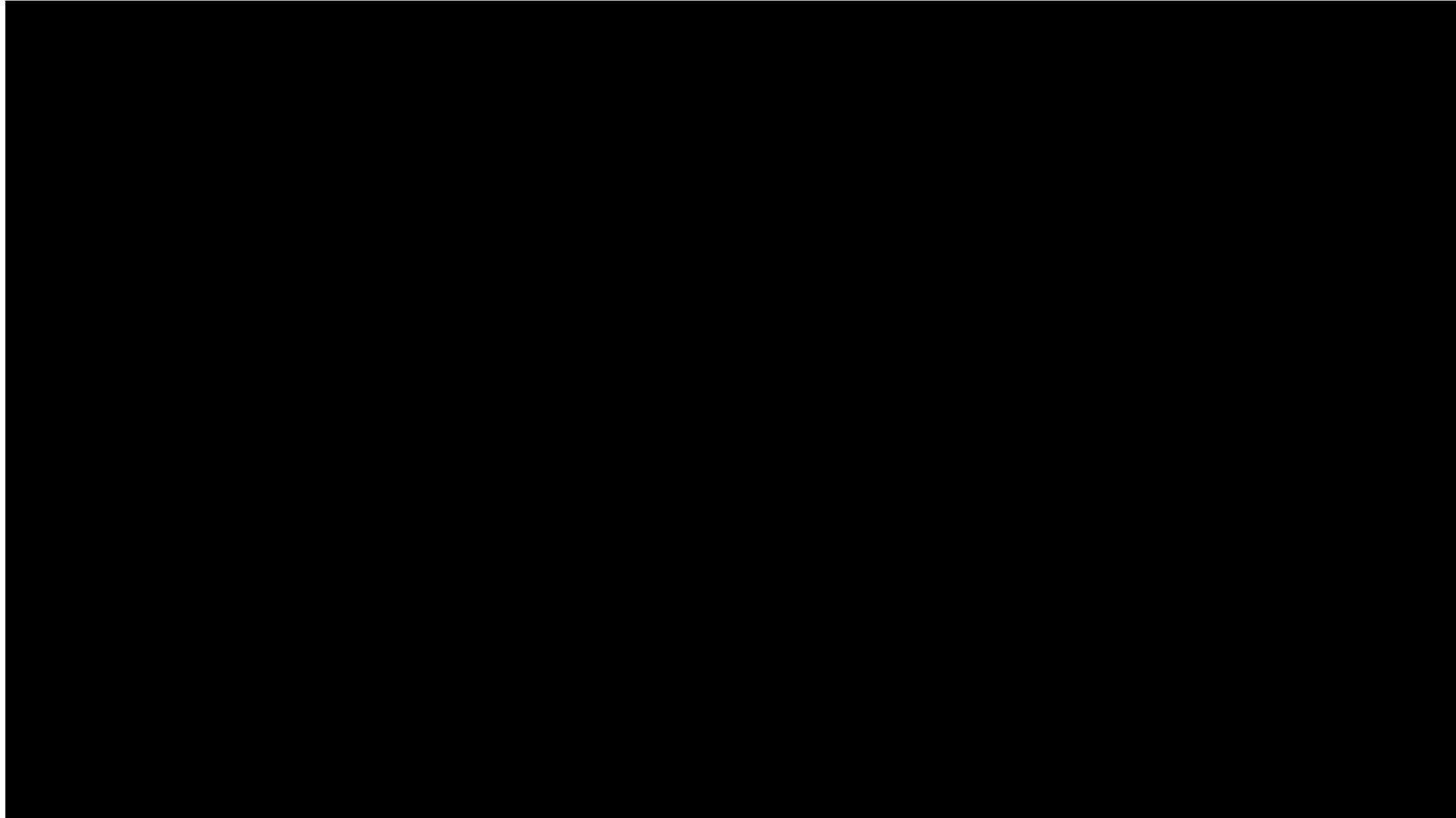
- Omnidirectional base (**tilted octocopter**)
- 7-DoF industrial robot arm
- Modular end-effector
- **High payload capacity**



- Fully **autonomous** assembly system
- **X8 drone base**
- 6-DoF active robot arm
- 1-DoF gripper
- Visual servoing algorithm for **grasping and deploying**



- Tilting quadcopter with 1-DoF
- Autonomous approach to the surface
- Direct force/torque control



- X8 drone base
- Lightweight arm with **elasticity compensation**
- Perching on energized power lines
- **Install, remove or repair** all kinds of devices



AERIAL-CORE

AERIAL Cognitive integrated multi-task Robotic system with Extended operation range and safety

Integration experiment - Aerial Manipulation
 CATEC - ATLAS Tactical Center
 February 13-24, 2023



University of Zurich UZH



FuVeX



SDU
 UNIVERSITY OF SOUTHERN DENMARK

endesa
 Distribución



- x8 drone base
- 5-DoF lightweight robot arm
- Miniaturized 6-DoF force/torque sensor in the wrist
- **Modular NDT tool**
 - UT
 - EMAT
 - Eddy Current
- **Active interaction force control**



Development of a semi-autonomous framework for NDT inspection with a tilting aerial platform

Salvatore Marcellini, Simone D'Angelo, Alessandro De Crescenzo, Michele Marolla, Vincenzo Lippiello and Bruno Siciliano

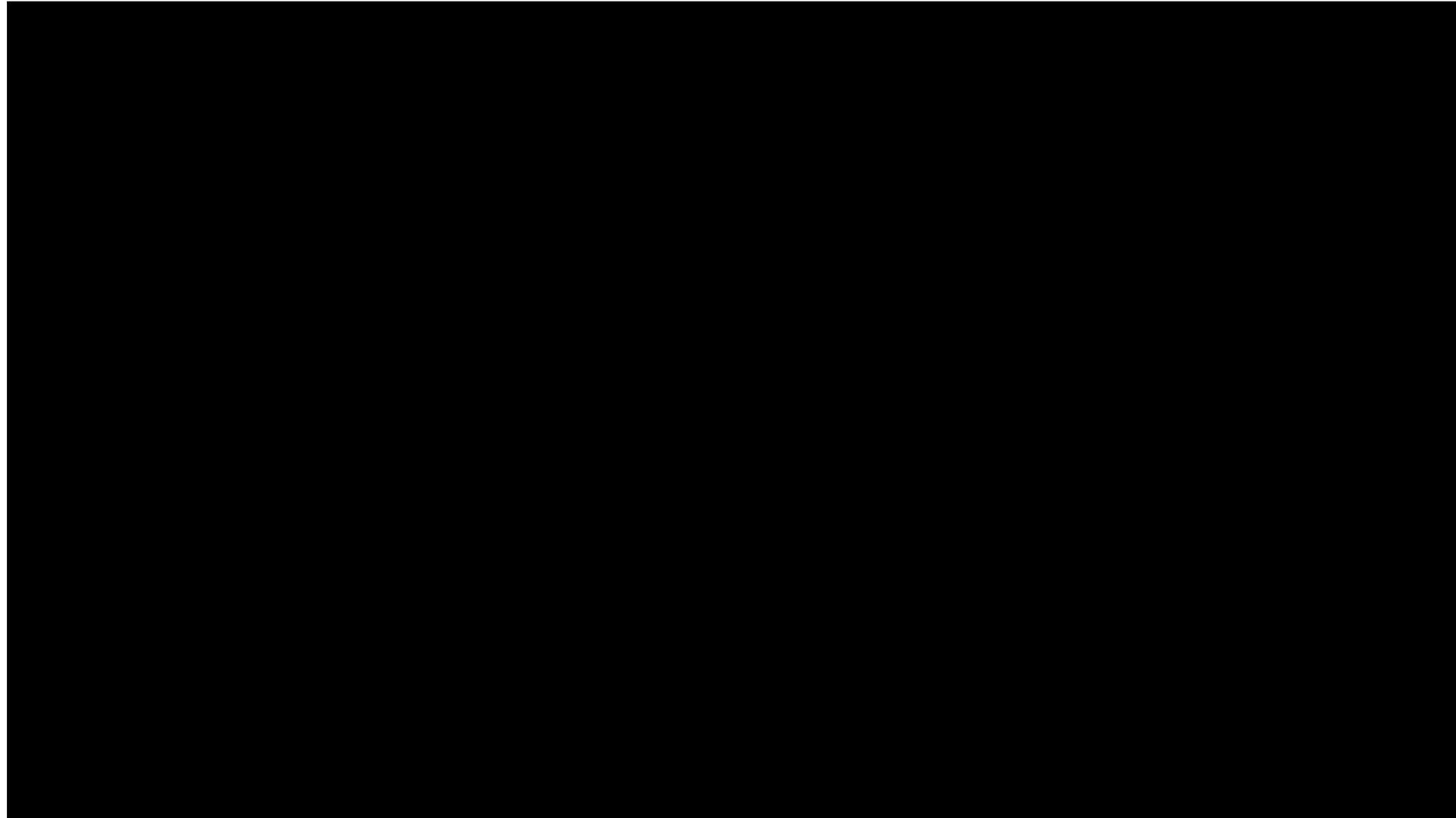
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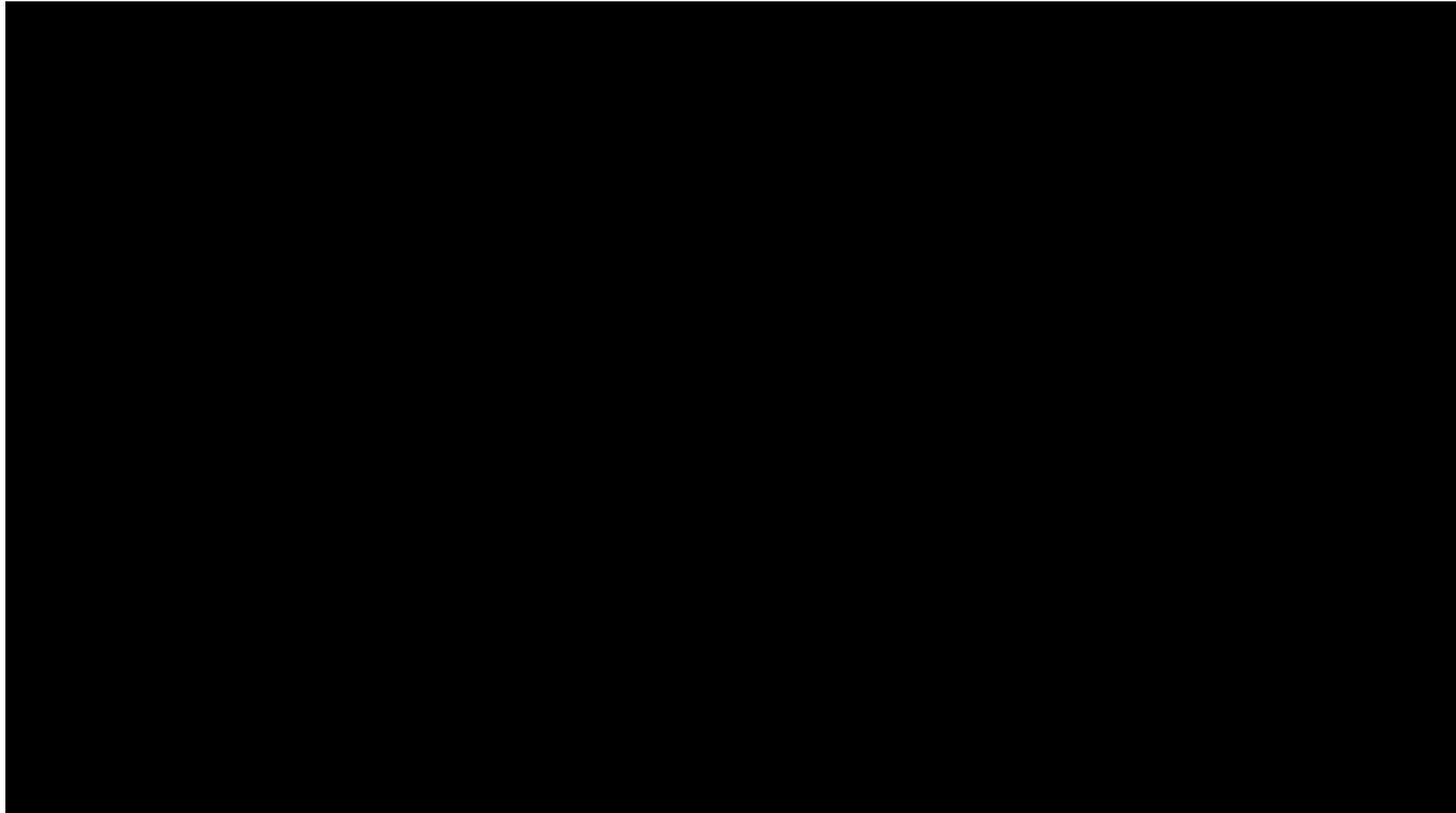
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- H6 drone base
- Hybrid drone endowed with a mobile base and a robotic arm
- Circular end-effector
- Modular NDT tool
 - UT/EMAT
 - Eddy Current
- Autonomous landing



- Hexacopter drone
- Buoyancy capability
- Aerial multispectral monitoring and measurement in deep water of biological and polluting parameters
- Recovering base station for autonomous 24H remote operation

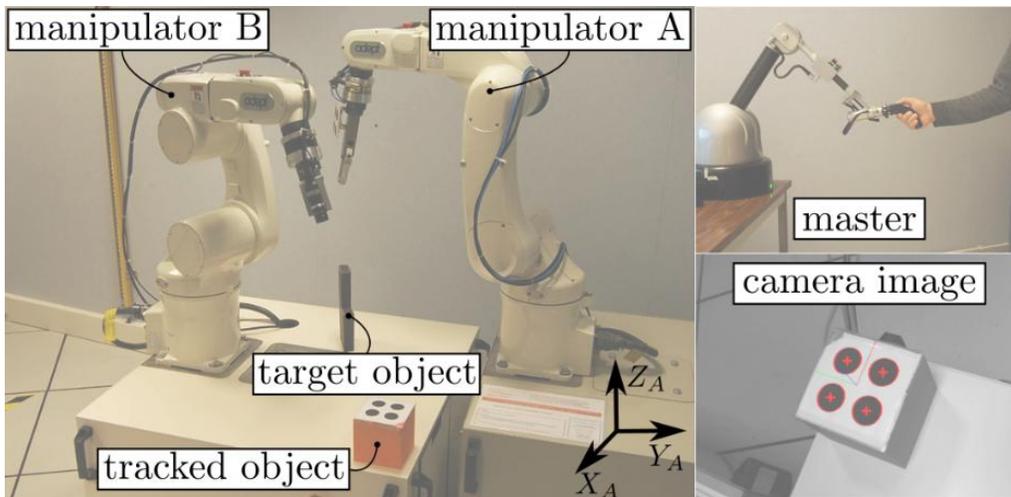
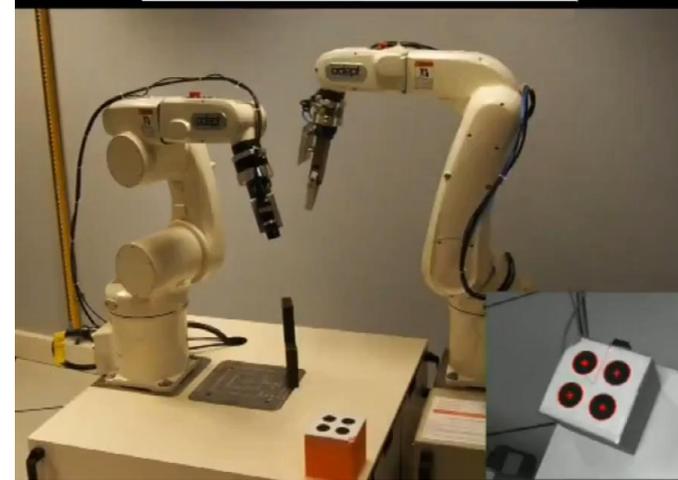
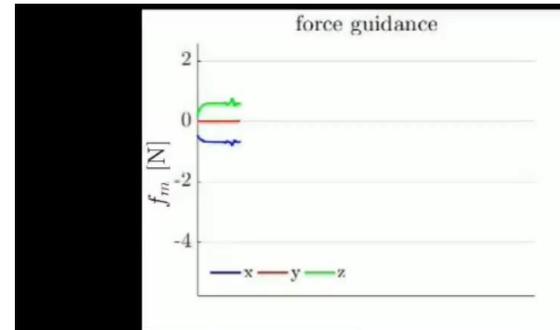




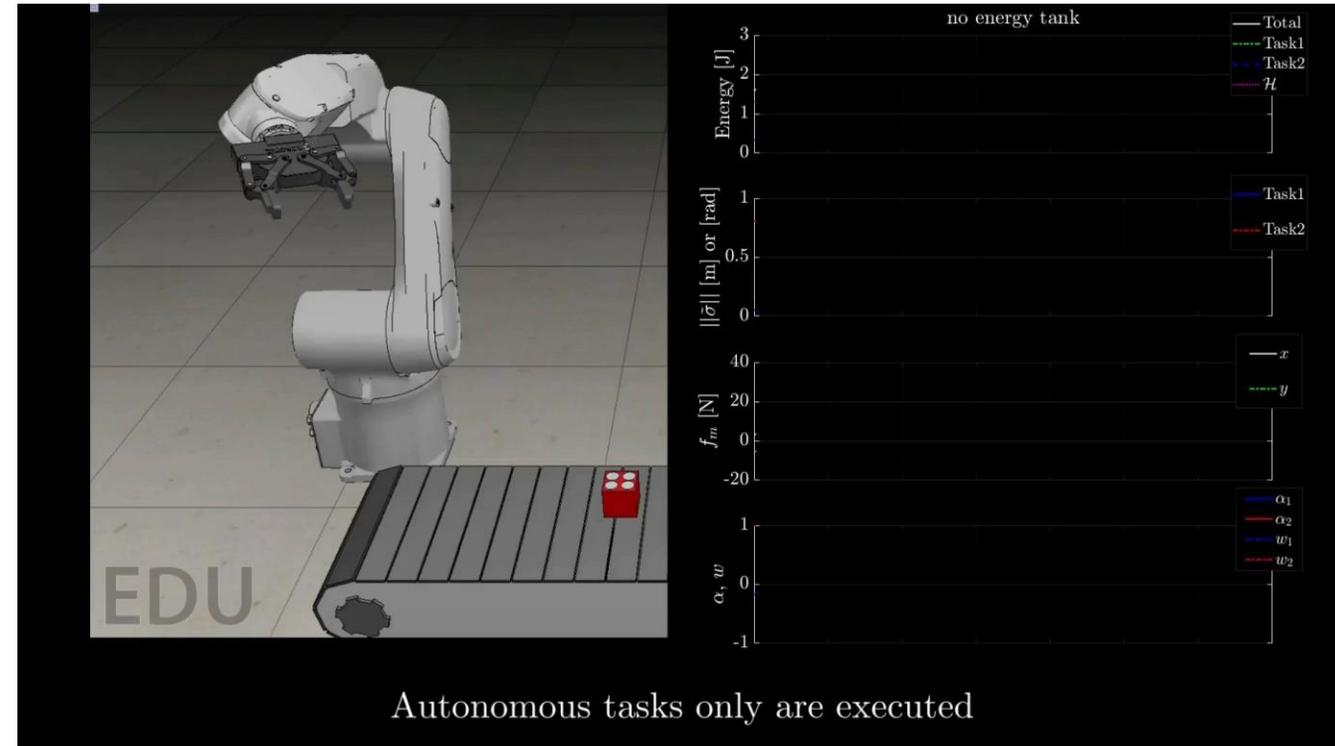
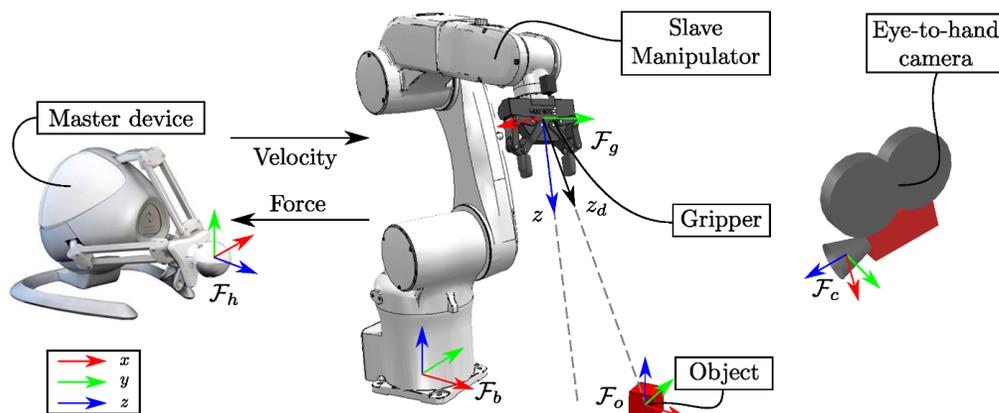
Haptic Shared Control

- **Shared-control** telerobotic systems are those in which a human operator trades the control of the remote robot with an autonomous controller for achieving a common goal
- The aim of the **autonomous controller** is to reduce the operator's physical and mental workload when controlling a complex robotic system for a long time period.
- In this context, **haptic guidance** methods can be beneficial to inform the operator about constraints acting on the teleoperation system
- **Haptic shared control** = shared control + haptic guidance

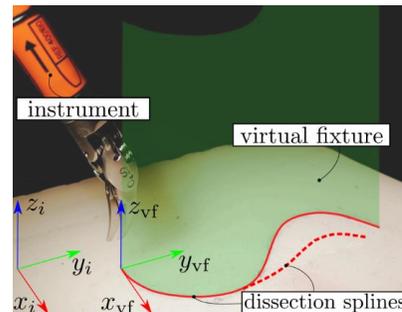
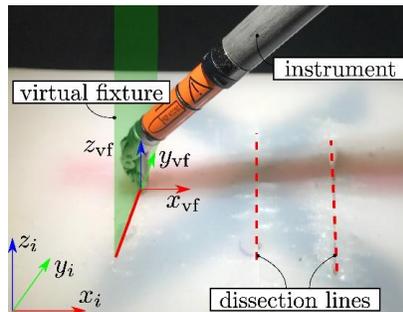
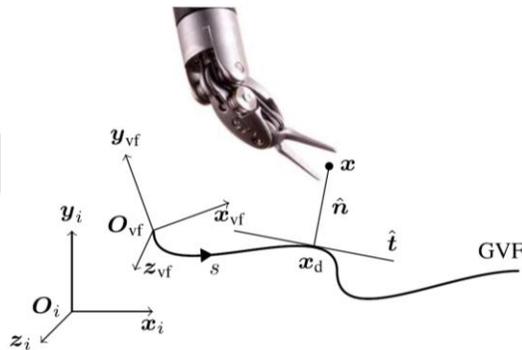
- **Dual-arm** semi-autonomous system
- Vision-based control and collision avoidance
- **Haptic guidance** to avoid constraints (joint limits, collision, singularities)
- Human subject evaluation



- Redundant semi-autonomous remote system
- **Task-prioritized** shared control teleoperation (autonomous + human tasks)
- **Haptic guidance** interface informing about constraints
- Passivity-based control

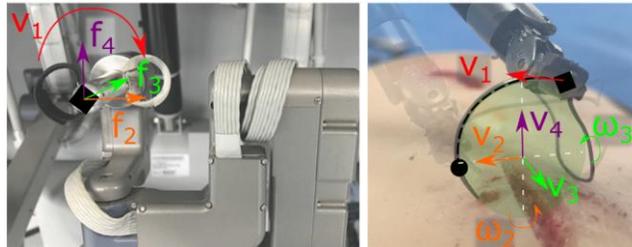


- Human-in-the-loop **virtual fixtures (VFs)** generation/adaptation
- Variable impedance **haptic guidance**
- Passivity-based control



- **Interactive** suturing stitch planner
- Comparison among
 - Full teleoperation
 - Supervised control
 - Shared control using virtual fixtures
 - Shared control using orientation mapping

Shared control Mapping



Shared control VF

