

# Research Presentation

Michele Focchi

# Outline

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■ Academic Curriculum

■ Teaching

■ Projects and Grants

■ Technology Transfer

■ Research Highlights

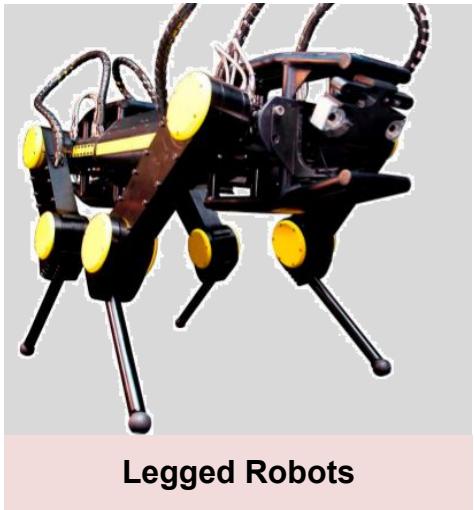
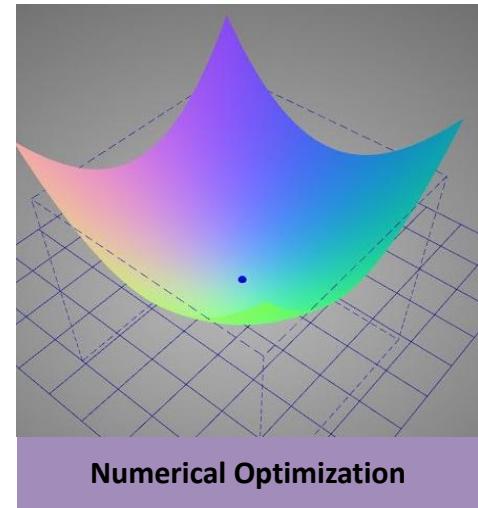
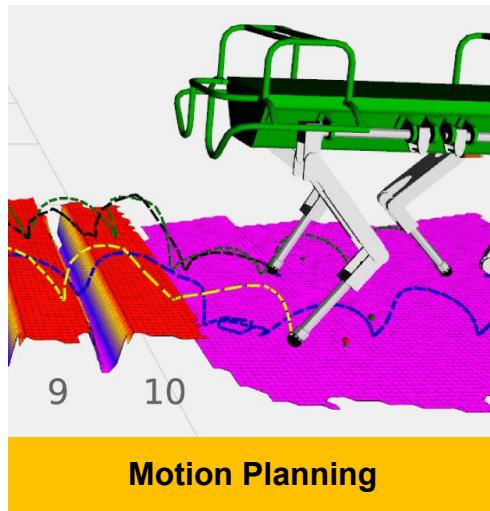
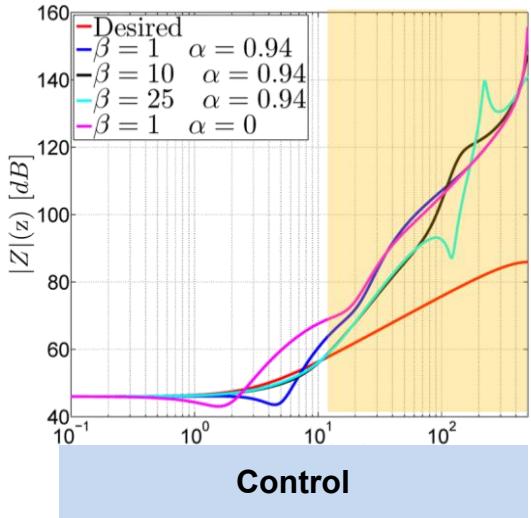
# My Academic Journey

- 2021-2024  
*Assistant Professor (RTDA)*  
**University of Trento**
- 2013  
*PhD Internship*  
**Max Plank institute**
- 2010-2021  
*PhD / Researcher*  
**DLS lab**  
**Istituto Italiano di Tecnologia**
- 2007  
*MSc Thesis*  
**Universidade Federal  
de Santa Catarina**
- 2005  
*MSc Internship*  
**Universidad Politecnica de  
Valencia**
- 2001-2007  
*BSc / MSc*  
**Politecnico di Milano**
- 2024-Today  
*Scientific Advisor*  
**All3 Robotics, London**



# My Areas of Expertise

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Journals



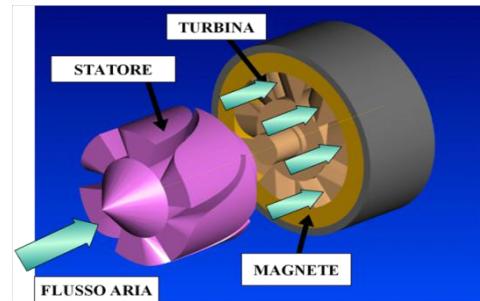
Conferences

# Previous experiences

2008

2009

PATENT



2010



R&D



Fellow

Mictoturbine

[TURBOEXPO 11]

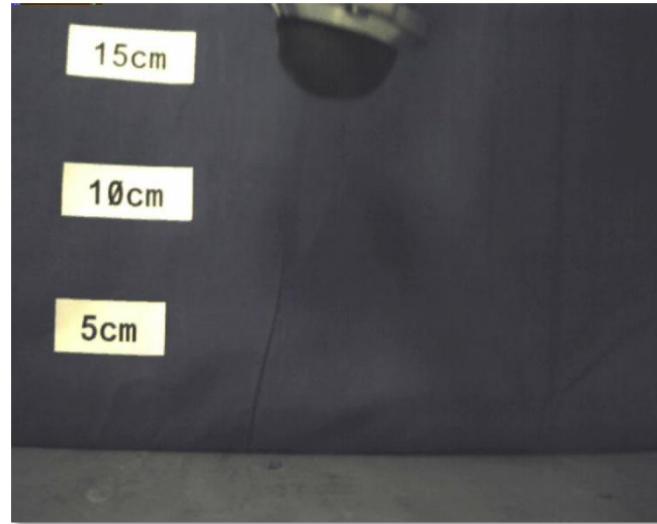
SPIN OFF



# Academic Career Overview

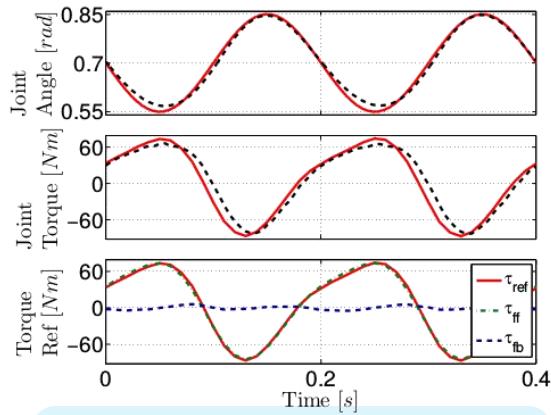


Magneto-rheological damper  
[JMD 14]

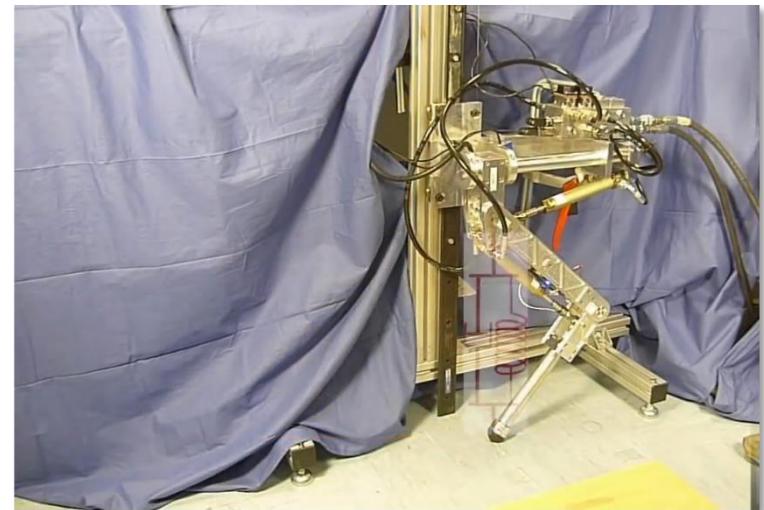


PhD  
in robotics

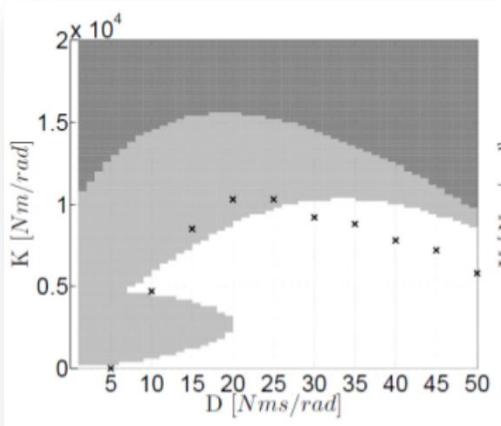
2010



Hydraulic force control  
[ICRA 12]



# Academic Career Overview

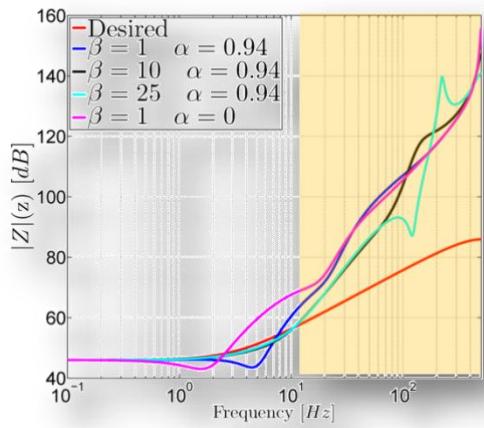


874 citations

2013

2014

HyQ [JSCE 11]



Stability regions in  
Impedance Control  
[CTT 16]



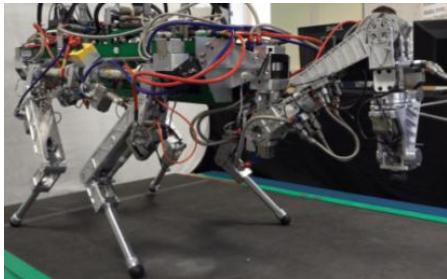
PhD  
in robotics

Whole-body  
control  
[AURO 17]

220 citations

# Academic Career Overview

2014



Control of HyQ-Centaur  
[ICRA 16]



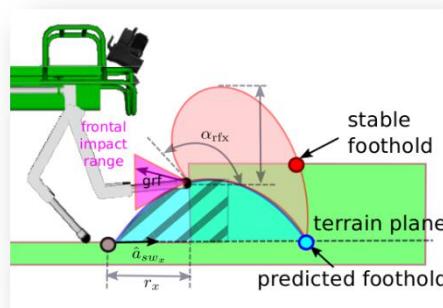
Heuristic planning  
[SPRINGER 19]



Researcher



HyQ2max  
[TMECH 15]



Step Reflex  
[CLAWAR 13]

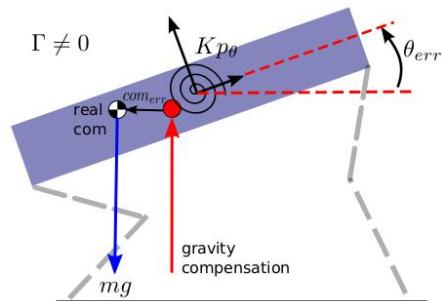
2015



Slip detection & recovery  
[ISRR 15]

# Academic Career Overview

2015



Online CoM Identification  
[IROS 17]

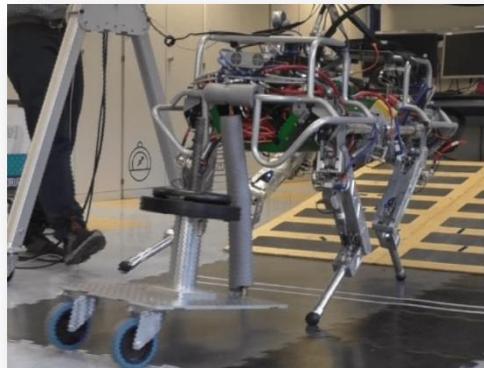


2017

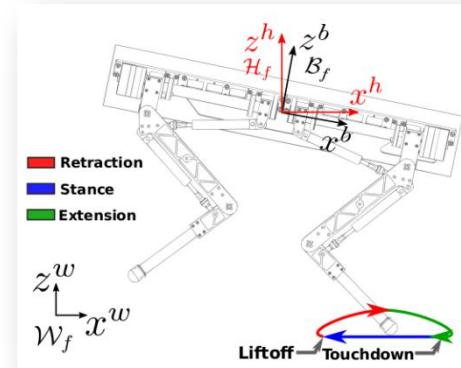
Stair climbing  
[SPRINGER 19]



Researcher



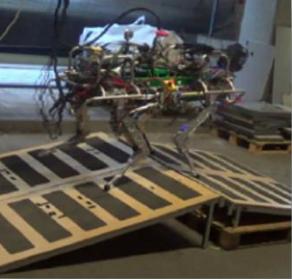
Disturbance  
Observer



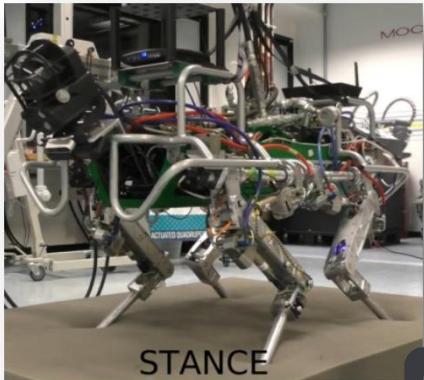
Bounding  
[CLAWAR 17]

# Academic Career Overview

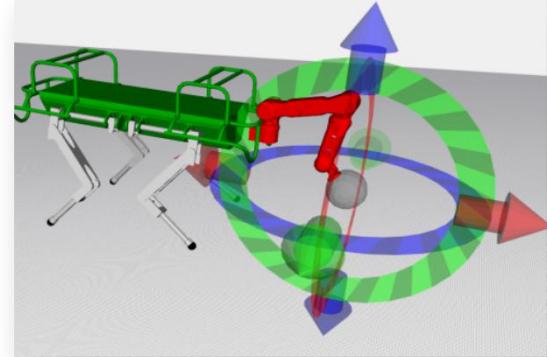
2017



Locomotion  
on soft-terrain  
[T-RO 19]

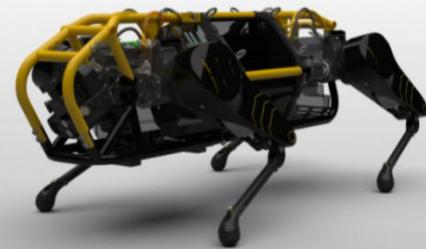


Hierarchical  
Whole-Body control  
[FRONTIERS 20]

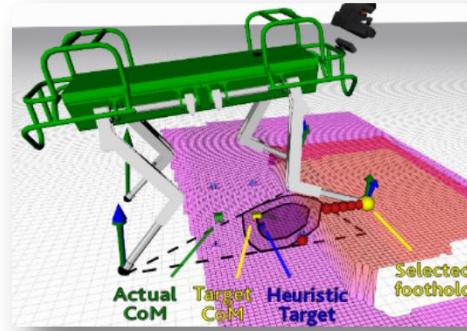


Researcher

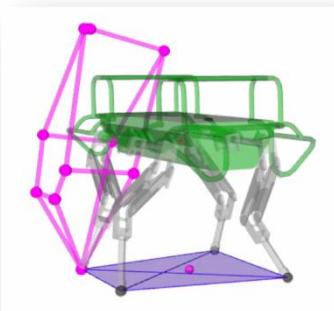
2019



HyqReal  
Robot

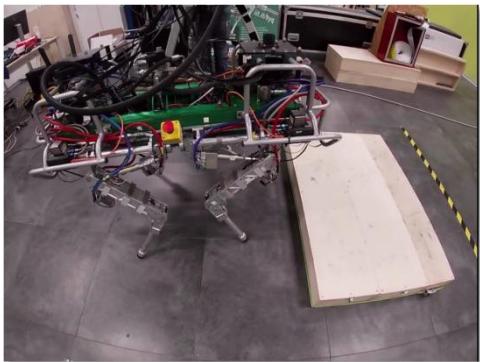


Feasible Region  
planning  
[T-RO 19]

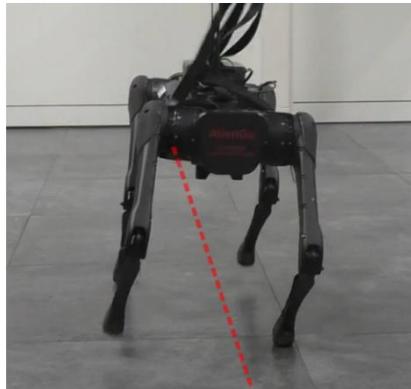


Wrench  
Polytope  
planning  
[RA-L 19]

# Academic Career Overview

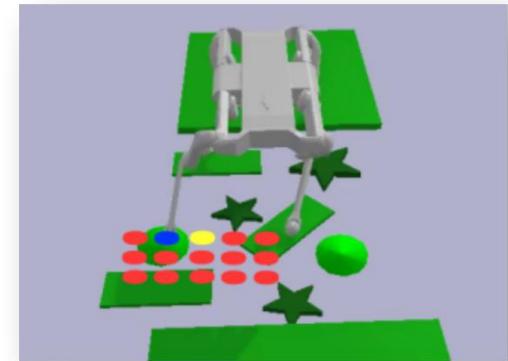


Bemporad  
IMT



NMPC planning  
with mobility  
[IEEE Access 21]

Reference Generator  
for NMPC [Sensors 23]



Acyclic Foothold Planning  
[Ubiquitous Robots 24]



2019



Researcher



Space – Non Wheeled all-  
terrain rover



INAIL

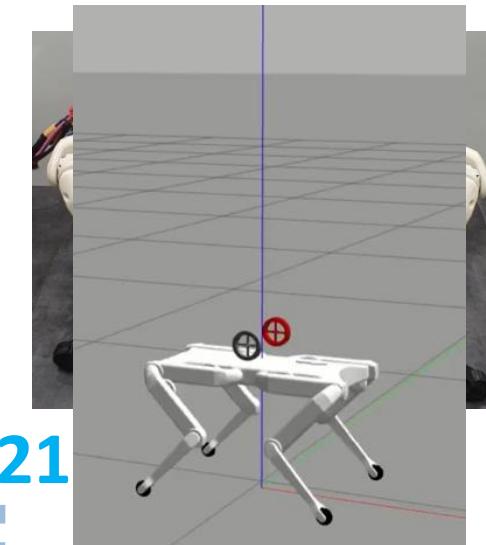
Tele-operation



2021

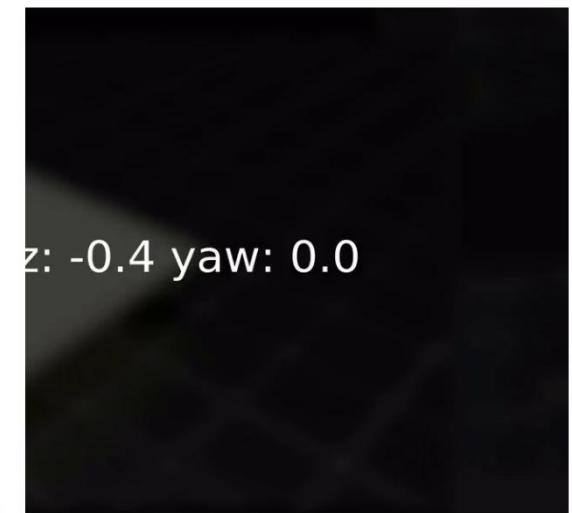
# Academic Career Overview

2021



Flight orientation  
Control [Sensors 23]

GPU based Guided RL for  
quadruped jumping



Reactive Landing Strategy  
[RA-L 23]



UNIVERSITÀ  
DI TRENTO

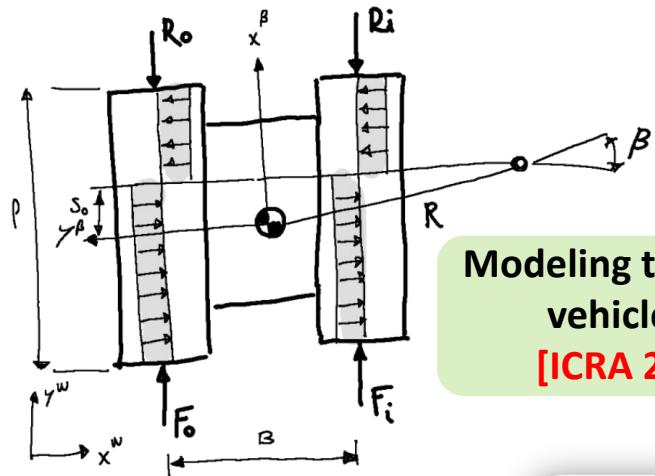
RTDA



2022

Locomotion  
Framework

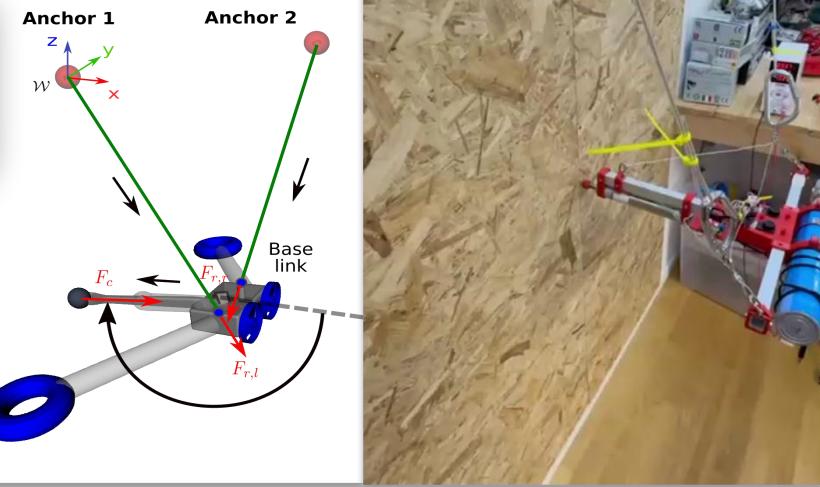
# Academic Career Overview



Modeling tracked vehicles  
[ICRA 24]



A. Peer  
UNIBZ



Climbing robot  
[ICRA 23-RAS 2025]



UNIVERSITÀ  
DI TRENTO

RTDA



K. Ellenrieder  
UNIBZ

Human-Robot Shared Control  
[T-ASE 24]

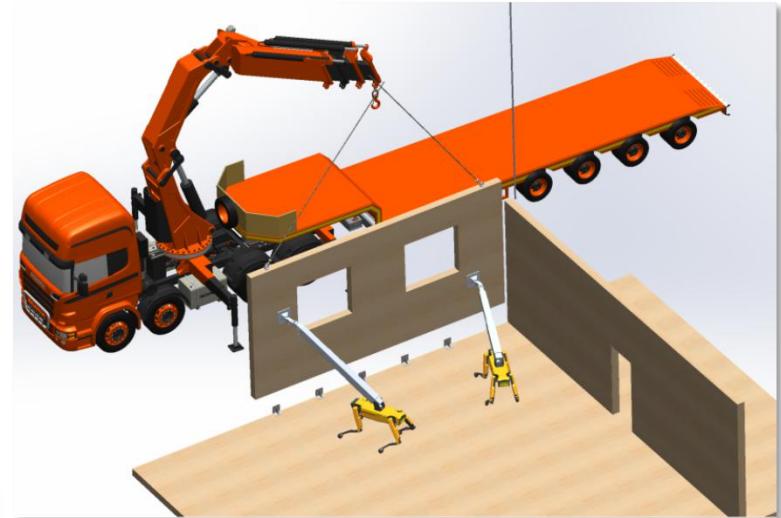


I-RIM/ERF: Dog Challenge  
Organizer

# Academic Career Overview



Autonomous  
Construction Systems

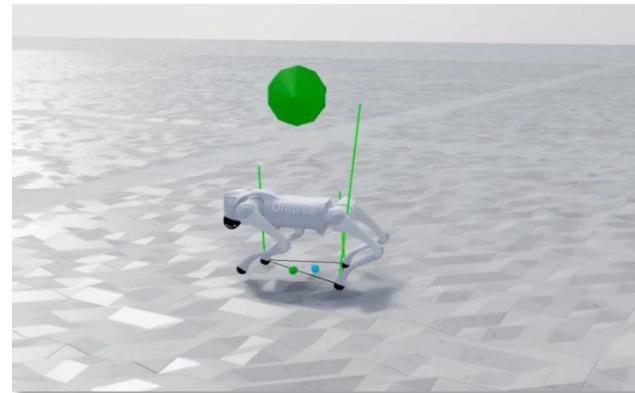


All3

Scientific Advisor  
All3 Robotics, UK  
50+ employees

2024

- Research topics:
  - Load sharing strategies: **FISA (10 M€)**
  - Dynamic obstacle avoidance: **EU HORIZON (4 M€)**



RL-based quadruped  
locomotion

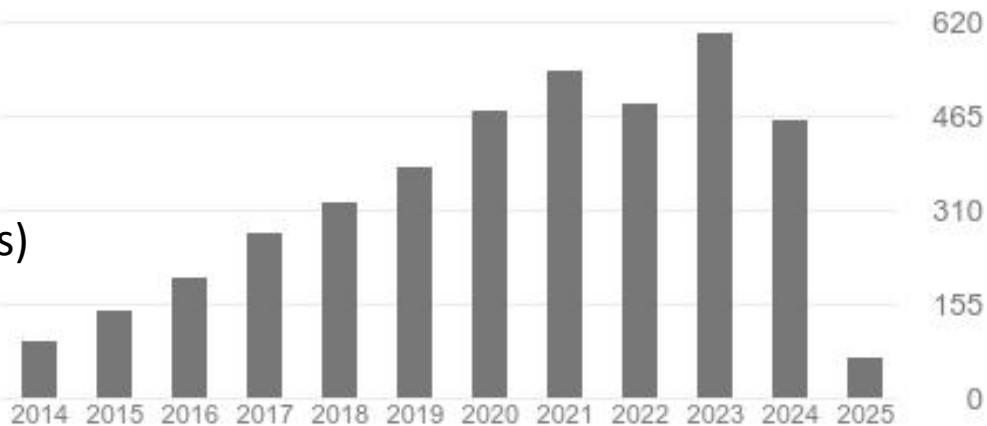
Today

# Academic Performance

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## Bibliometric indexes:

- H-Index: **32** (Scholar), 26 (Scopus)
- Citations: **4218**(Scholar), 2760 (Scopus)



## 53 papers:

Source Google Scholar (on 17/03/25)

- 10: **100+** citations
- 24 International journals (RA-L, T-RO, AURO, RAS...)
  - 11: **≤2°** author

# Teaching & Student Supervision

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## Bachelor Courses:

- Foundation of Robotics (12 CFU, University of Trento)
- Fondamenti di Automatica (6 CFU, University of Trento)

Total  
125h

## Master Courses:

- Introduction to Robotics, in English (Chair, 6 CFU, University of Trento)

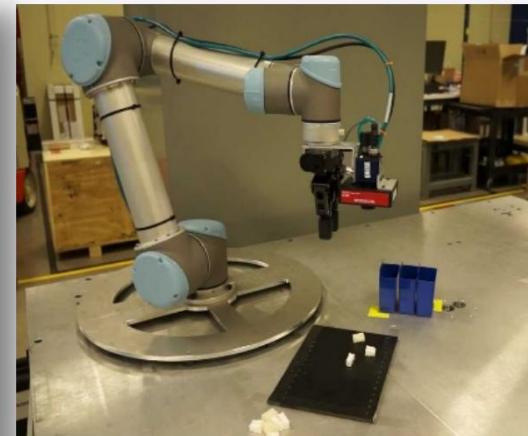
## PhD Courses (total 26 h):

- Control of Legged Robots (Chair, University of Genova)
- Control of Robots (Chair, University of São Paulo)

# Teaching & Student Supervision

## Research supervision:

- PhD cycles (main-supervision): **4**
- PhD cycles (co-supervision): **5**
- Master thesis: **9**



## Lab Tutoring:

- Setting-up two robotics labs at UNITN
- Practical lab activities

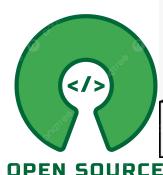
LocoSim™

**UR5 ARM**

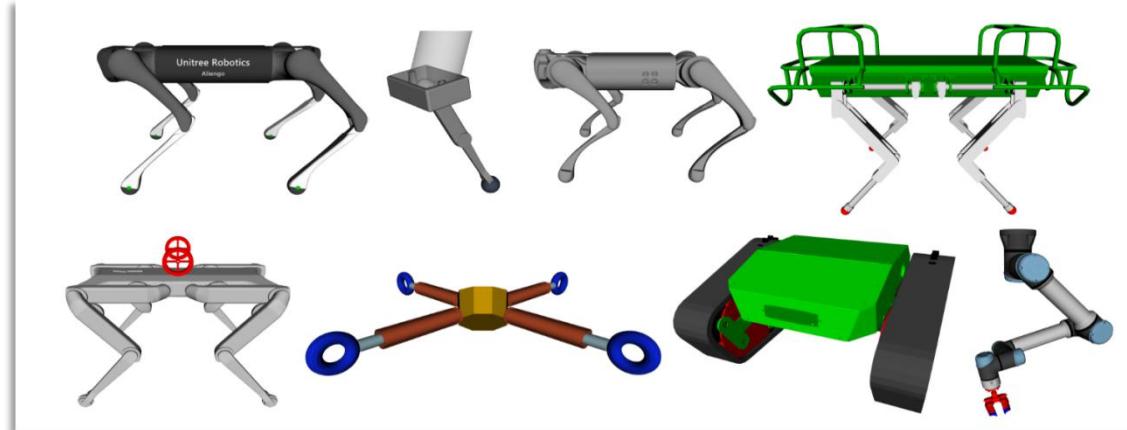
Pick-and-Place with anthropomorphic 6-DoFs arm

# Teaching and Research Software - Locosim

- Development of didactic framework for robot simulation: 250+ active users



[github.com/mfocchi/locosim](https://github.com/mfocchi/locosim)



- Simulate both fixed-base and floating-base robots

Modular



Extensible



Feature rich



Library of robots



Rapid prototyping



Real-time friendly



Easy to learn



Easy to install



# Grants and Projects

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- EU FP7 - Echord++ (IIT), 2016-18, **300k€**

*- Design and control of an autonomous quadruped platform*

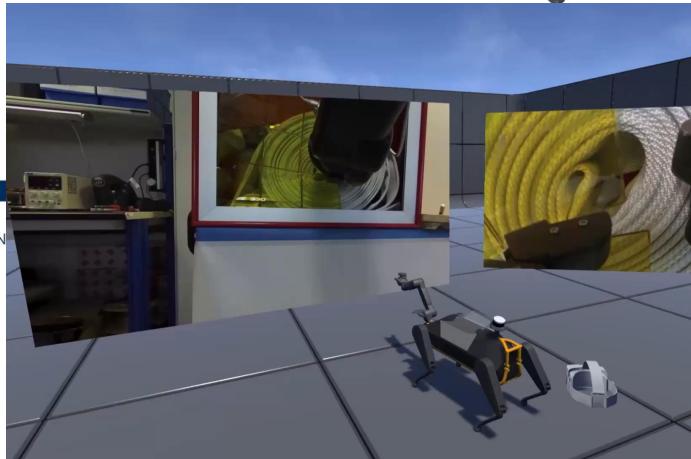


- INAIL (IIT), 2017-23, **5.4 M€**

*- Enhance safety in hazardous environments*



ISTITUTO NAZIONALE PER L'ASSICURAZIONE  
CONTRO GLI INFORTUNI SUL LAVORO



- European Space Agency - ANT (IIT), 2020-21, **400k€**

*- Planetary exploration*



- RECOARO (UNIBZ) (Provincial funds)

*- Agricultural applications*



# Technology Transfer

- Micro-turbine for power generation



**PATENT**

WO 2012/00473

**PRIZE 25k€**

PNICube Innovation  
2013



**SPIN OFF**



- Funding member of the MOOG-IIT joint lab (2015-21): 3M€ (inkind)



**MOOG**

**iit** ISTITUTO  
ITALIANO DI  
TECNOLOGIA



# Miscellaneous Responsibilities

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- Founding member (2014) of the **Dynamic Legged Systems** Research Line (IIT)
- Qualification for associate professor (ASN):
  - **ING-INFO5**
  - ING-INF04
  - ING-IND13
- Editorial service
  - RA-L, ICRA, Frontier and AI Associate Editor
  - PhD panel board: 2
  - ERC Synergy grant reviewer
- Workshop Organization: (RSS, ICRA), Invited Speaker (ICRA, ICAR, I-RIM..)
- IEEE Senior Member
- Indam Member - Istituto Nazionale di Alta Matematica "Francesco Severi"

# Dissemination

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## National TV interviews:

- TG5
- TGR leonardo
- **TG2**
- **TG3-pixel**
- "Le iene"

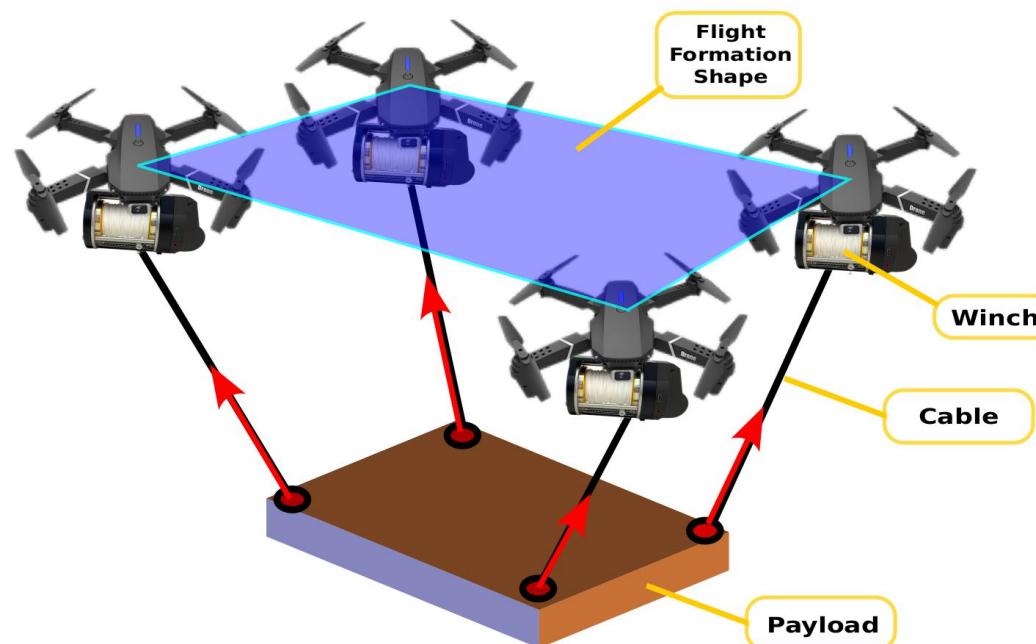


## Demos:

- Maker Faire, Rome (2019)
- HyQReal Pulling a plane,  
Genova airport (2019)
- ERF, Rovereto (2014)
- RSS, Rome (2015)

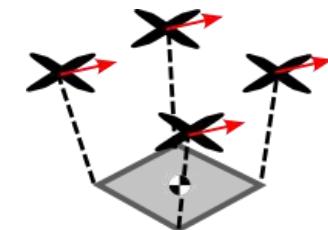
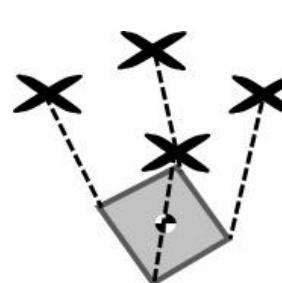


# Cooperative Aerial Manipulation

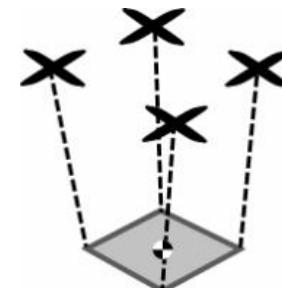


## Features:

- Full 6D payload manipulation
- Decoupling payload motion from the swarm formation shape



Linear Motion



imgflip.com  
Null-space Motion

■ FIS3 Consolidator submitted (**1.5 M€**)

■ Perspective Collaboration

Prof. Sanguineti, Prof. Bagnerini  
(University of Genova)

■ Patent application

# Fire suppression application



# Collaborations



Karl von Ellenrieder  
Angelika Peer



Jonas Buchli



Ludovic Righetti



Max Planck Institute for  
**Intelligent Systems**



Thiago Boaventura



Leonardo Lanari

Questions?



Patrick Wensing



Stéphane Caron



Maurice Fallon



Nicolas  
Mansard



SCHOOL  
FOR ADVANCED  
STUDIES  
LUCCA

Alberto Bemporad  
Mario Zanon



**Thanks for your attention!**

[michele.focchi@ieee.org](mailto:michele.focchi@ieee.org)