

# Humanoid Robotics Research at the DFKI Robotics Innovation Center

GTAI Digital Seminar: "Rise of the Robots"



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- 1 DFKI Robotics Innovation Center
- 2 Humanoid Research in VeryHuman Project
- 3 Collaboration and Investment Opportunities



# DFKI Robotics Innovation Center



# Humanoid Research in VeryHuman Project

## Goal

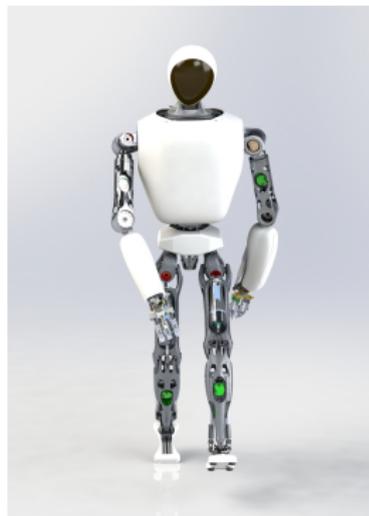
Learning and Verifying Complex Behaviours for Humanoid

## Challenges

- humanoid walking is **hard** – stability is not guaranteed unlike multi-legged or wheeled robots
- robust hardware design is needed
- accurate simulation of system dynamics
- lack of knowledge about the rewards and constraints
- verifying and proving the complex behaviours

## Approach

Combine modern optimal control theory with machine learning to develop effective and robust walking strategies



RH5 Humanoid

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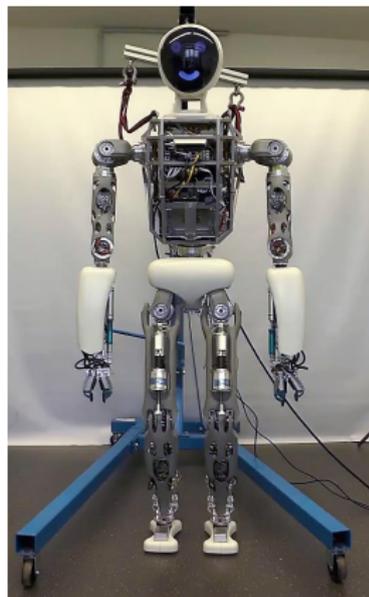
Learning and Verifying Complex Behaviours for Humanoid

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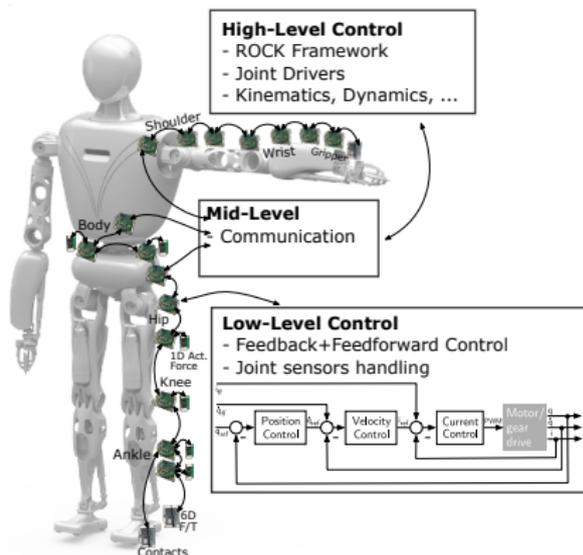
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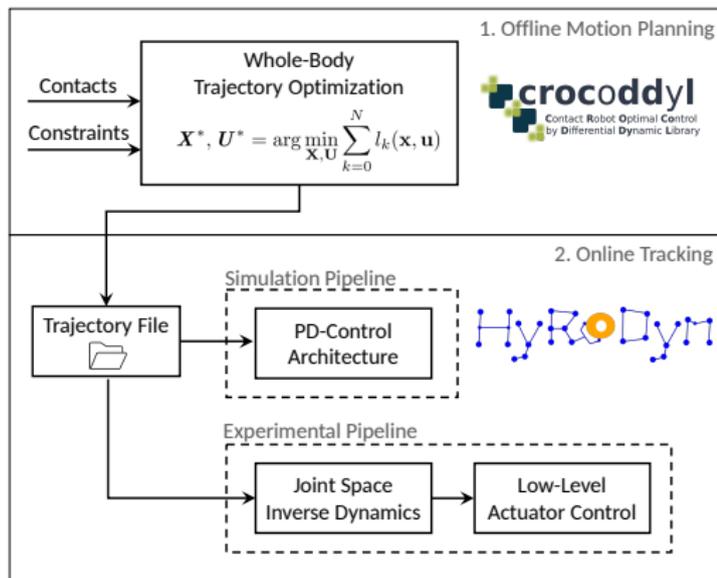
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RH5 Humanoid



Overall Processing Architecture



High-Level Control Architecture



## Design, Analysis and Control of the Series-Parallel Hybrid RH5 Humanoid Robot

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Gea Fernandez<sup>1</sup>, Carlos Mastalli<sup>2</sup>, Olivier Stasse<sup>3</sup>, Frank Kirchner<sup>1,4</sup>

1 - DFKI Robotics Innovation Center, Bremen, Germany

2 - Alan Turing Institute, University of Edinburgh, Edinburgh, United Kingdom

3 - GEPETTO group, LAAS-CNRS, Toulouse, France

4 - Working Group Robotics, University of Bremen, Bremen, Germany



# Collaboration and Investment Opportunities

## High Collaboration Potential

- Past:
  - RICOH – shareholder at DFKI
  - Several exchanges with JAXA
- Present:
  - Ongoing negotiations to open a joint lab\* between DFKI and Osaka Prefecture University
  - Prof. Wahlster (Chief Executive Advisor, DFKI) has served various advisory boards in Japan (e.g. German Japanese Forum on Information Technology, ITRI, NII).
- Future:
  - shared interest in automation and robotics
  - research collaboration especially in humanoid robotics

\* For more info: <https://www.dfki.de/en/web/news/lab-japan-opu>



Prof. Andreas Dengel (DFKI Kaiserslautern) received "Distinguished Honorary Professor" title in Osaka in 2018.



## Next Generation Robots

Industry grade cooperative and AI based Robots are or will become an option in the next 5 years



## Competitiveness

Companies in production and service sector are forced to transform their business to stay competitive



## Cost

The cost for this transition and the uncertainty factor are huge



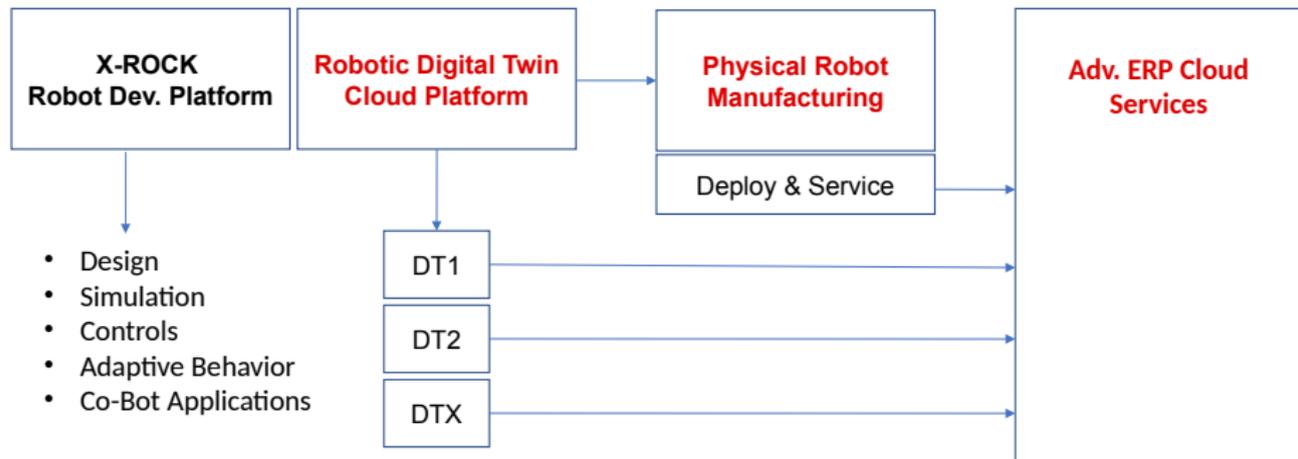
## Know-How

There are simply not enough experts available to support the industry in this transition process

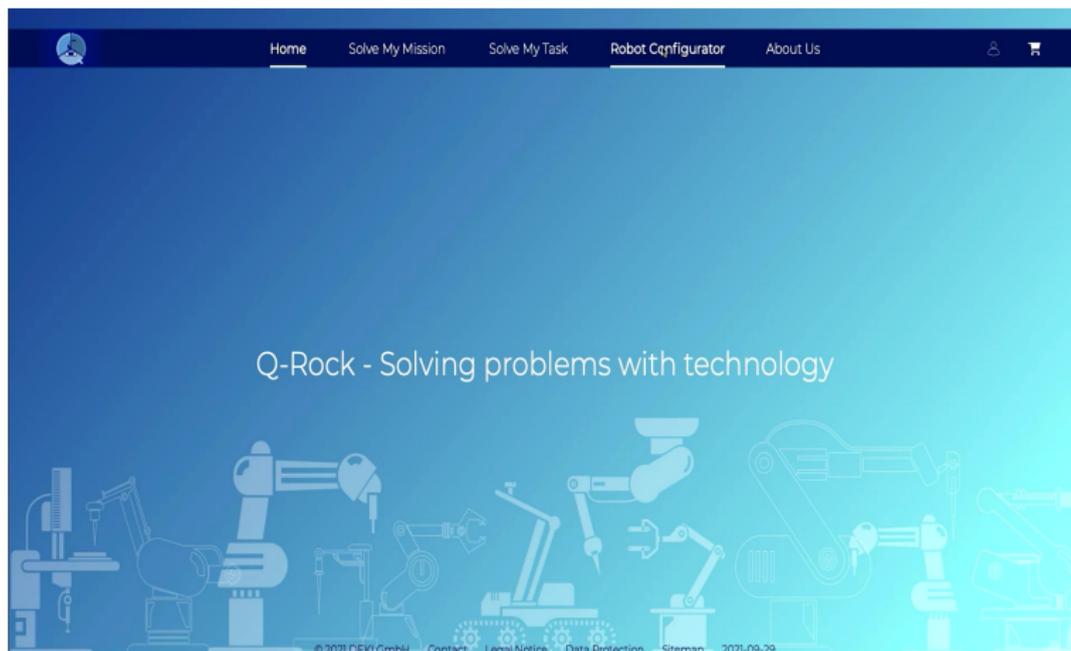


## Solution

X-ROCK provides a solution to manage the transition process without the need for experts



X-RoCK is a spin-off product from DFKI Robotics Innovation Center's Q-RoCK platform. For more information, visit: <https://robotik.dfki-bremen.de/en/startpage/news/entry/customized-robots-fo/>



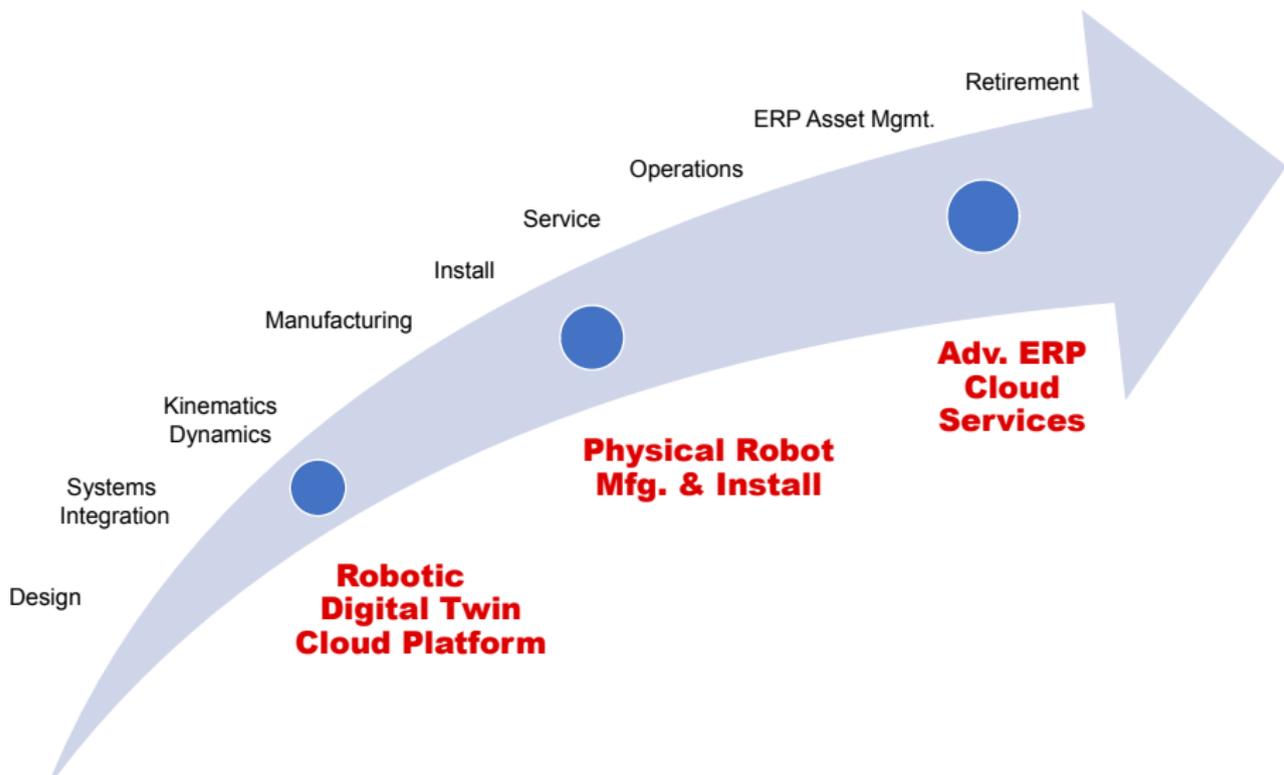
# Value Proposition: Bringing AI into Robot Lifecycle Value Chain



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# Thank you very much! Questions?



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## Team VeryHuman

Scientific Leaders:



Project Leaders:



Robotics Innovation Center

Cyber-Physical Systems