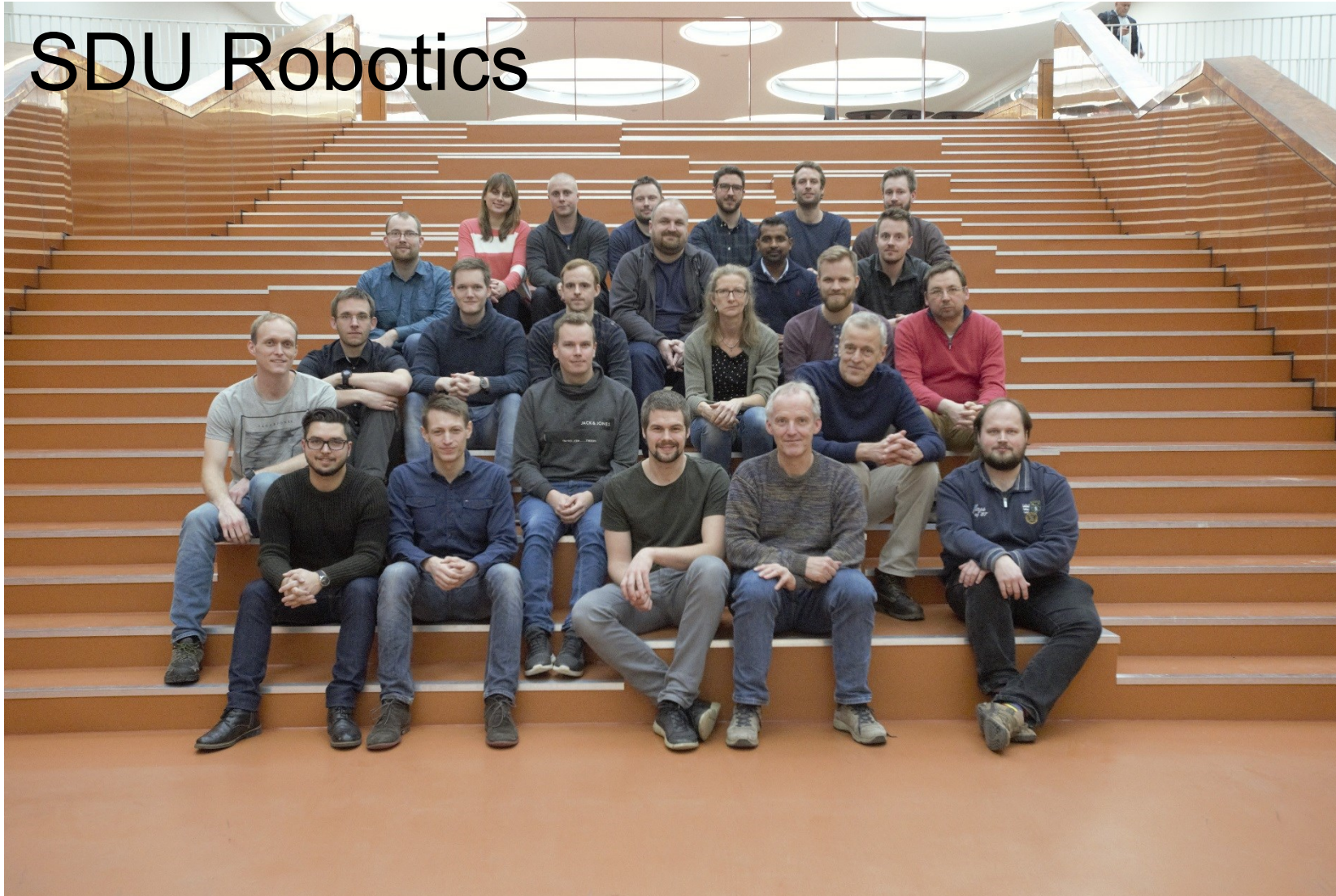


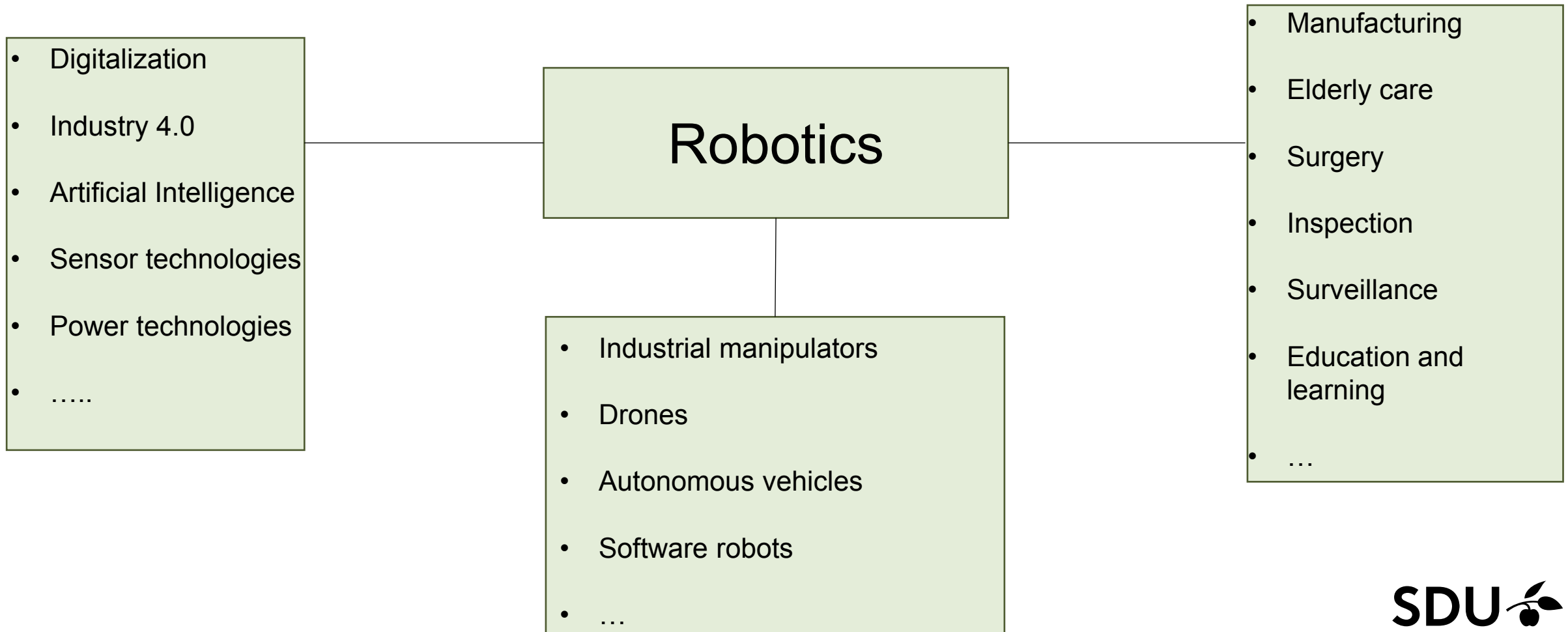
Henrik Gordon Petersen
Section Leader, SDU Robotics
Maersk Mc-Kinney Møller Institute
University of Southern Denmark (Odense)



SDU Robotics



Robotics is a central driving force



COMPANIES



CLUSTERS AND PARTNERS



PUBLIC SECTOR AND BUSINESS SUPPORT PROVIDERS



FINANCING



ODENSE SEED AND VENTURE

Public Funding	Private Equity	Venture Funding
Crowd Investors	Business Angels (75+)	Loan and Bank Financing

100+ mill. Euros invested in 2016

EDUCATION

- BEng**
 - Electrical Power Engineering
 - Electronics and Computer Engineering
 - Global Management and Manufacturing
 - Integrated Design
 - Manufacturing Engineering and Management
 - Mechanical Engineering
 - Mechatronics
 - Robotics Technology
 - Software Technology
- MSc**
 - Applied mathematics
 - Computer science
 - Electronics
 - Energy Technology
 - Engineering Robot Systems (Advanced Robotics Technology and Drone Technology)
 - Information Technology - Product Design
 - Learning and Experience Technology
 - Maritime Technology
 - Mathematics
 - Mechanical
 - Mechatronics
 - Operations Management
 - Physics and Technology
 - Product Development and Innovation
 - Software Engineering
 - Welfare Technology



- Academy Profession AP**
 - Automation Technology
 - Computer Science
 - IT Technology
 - Multimedia Design and Communication
 - Production Engineer
- Bachelor BA**
 - E-Concept Development
 - PBA Software Development
 - Product Development and Technology Integration
 - Web Development
- Continuing Education**
 - Academic Education
 - Diploma

- Electricity Automation and IT**
 - Automatics Technician
 - Data Technician (+EUX)
 - Electrician (+EUX)
- Metal, Industry and Technology**
 - Automation Technician (+EUX)
 - Industrial Operator
 - Industrial Technician (+EUX)
 - Sheet Metal Worker (+EUX)
 - Technical Designer

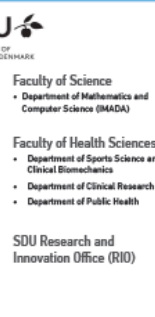


- Bachelor**
 - Marine Engineer
- OTHERS**
 - Lillebaelt
 - Odense Tekniske Gymnasium

RESEARCH, DEVELOPMENT AND INNOVATION



- Disciplines**
 - Advanced robots
 - Co-working robots
 - Sensors and robots
 - Mobile robots
 - Drones (UAS)
 - Personal care robots
 - Industry 4.0 and data
 - Virtual reality
 - Safety
- Activities**
 - Implementation of solutions
 - Dissemination, training and education
 - Analysis and consultancy



- Faculty of Engineering**
 - TEK Innovation
 - The Mads Clausen Institute
 - SDU Mechatronics
 - SDU Innovation and Design Engineering
 - The Mærsk Mc-Kinney Møller Institute
 - SDU Robotics
 - SDU UAS Centre
 - SDU Software Engineering
 - SDU Electrical Engineering
 - SDU Embodied Systems for Robotics and Learning
 - SDU Health Informatics and Technology
 - SDU Energy Informatics
 - Department of Technology and Innovation
 - SDU Mechanical Engineering
 - SDU Engineering Operations Management
- Faculty of Science**
 - Department of Mathematics and Computer Science (MADA)
- Faculty of Health Sciences**
 - Department of Sports Science and Clinical Biomechanics
 - Department of Clinical Research
 - Department of Public Health
- SDU Research and Innovation Office (RIO)**



- Cluster for Technological Innovation and Welfare**
 - Innovation Process
- OUH**
 - Odense University Hospital

COMPANIES ARE SELECTED BASED ON AN ASSESSMENT OF THE FOLLOWING PARAMETERS:

- Share of turnover in the robotic and automation industry
- Strategic focus
- Activity in cluster cooperation
- Dedicated technology

Updated: 26-01-2017

Robotics in Odense: Education is a potential bottleneck for the development

2015:

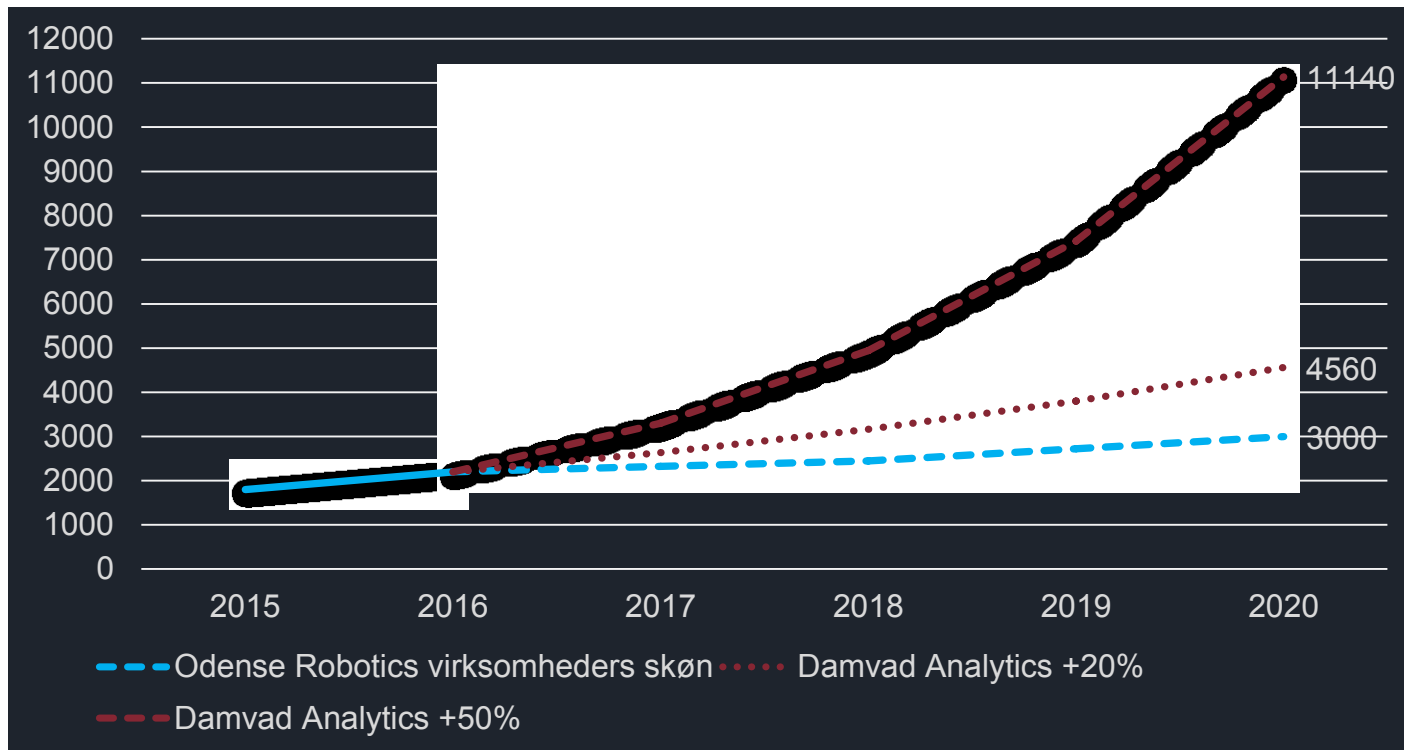
- 72 virksomheder
- 1800 medarbejdere

Primo 2016:

- 85 virksomheder
- 2200 medarbejdere

Primo 2017:

- 102 virksomheder
- 2600 medarbejdere



Integrating industry and academia: Manufacturing Academy of Denmark (MADE)

	Rapid Product & Production Development	Model Based Production	Complexity Management
Value Chain & Business Systems	High speed product development	Model based supply chain development	The "new" Manufacturing Paradigm
Integrated Production Systems	Modular production platforms for high speed ramp-up	Digitalization of supply chains	Hyper flexible automation
Enabling Technologies	3D print and new production processes	Lifelong product customization	Sensors and quality control

Current and future trends in research and development

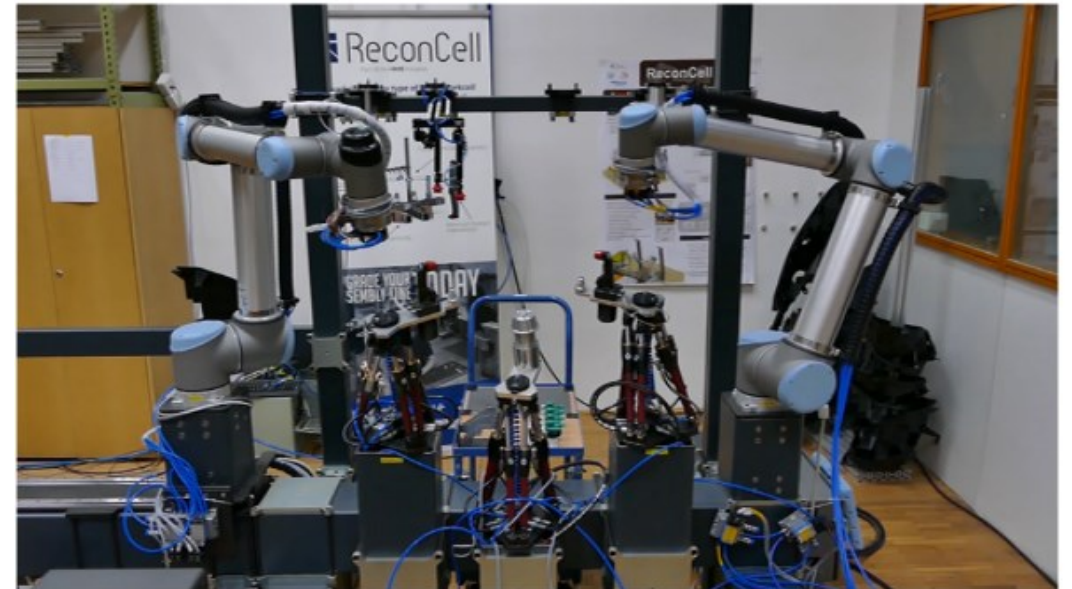
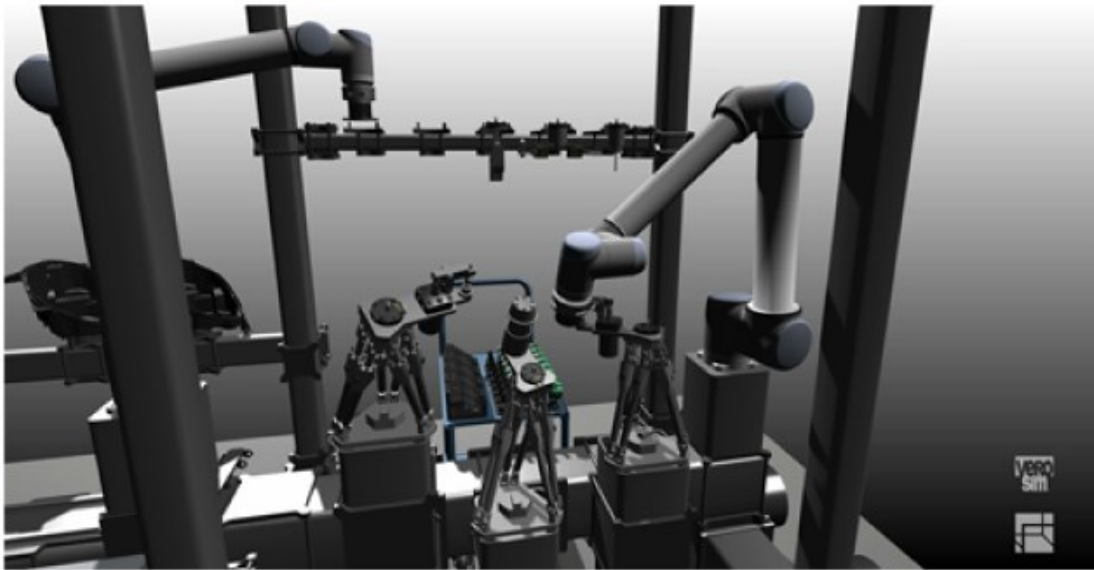
R&D in a variety of niches within various domains such as

- Trajectory planning/robot programming
- Process models
- Sensor technologies
- Artificial intelligence
- Human-robot interactions
- ...

Important shift of method: Increase of development in virtual environments that becomes more and more realistic (*digital twin*)

Programming and testing in virtual environments

Example from one of our European projects



Opportunities for Robotics in Denmark through market pull

Manufacturing:

- high quality demands that are only achievable through automation
- low batch sizes, rapid changes, small facilities
- requiring *cost effective* solutions that will often be first on the market
- requiring robots that can be handled by unskilled workers (easy programming)

Welfare/elderly care (domestic robots):

- Lack of people and time for performing the tasks
- Many tasks (even personal) are more suitable for robots
- Leave time for socializing with the elderly people

Threats

- Education bottlenecks
- Conservatism among technology providers
 - "Just wait for Germany to develop the technology"
 - "The technology is already there" (just too expensive 😊)
- Too restrictive safety regulations or major accidents (human robot collaboration)
- Some politicians will mislead the population (in Danish manufacturing, robots create jobs)
- Not enough funding for R&D
- Ownership of manufacturing (and other automated) facilities

The future

- Tedious work will be taken over by robots or by human-robot collaboration
- Denmark is a key player in the providing of robot technologies
- Danish manufacturing will stay competitive
- Societal challenges have been resolved (education, safety, public opinion, etc.)
- More life quality