



## PRECISE DEXTERITY

Industrial robots are bringing manufacturing jobs back to high-wage countries. Compared to their predecessors, these robots are easier to use, safer to operate, and more effective in dealing with parts and process changes. Against this exciting backdrop, MCH focuses its research on human-robot interface for fast set-up, robotic control for compliant motion, as well as powered caster wheel modules and other enabling technologies for mobile robotics. Complementary to the robotic research is the research and development of assistive technology to make complex and strenuous operations easier for humans. MCH's goal is to provide the critical parts of the automation solution for dealing with high-mix low-volume manufacturing which involves welding, assembly, surface finishing, and material handling.

The group carries out collaborative research with academic institutions, co-develops automation equipment and machines with companies, transfers technology, and conducts training for the manufacturing industry.

### Core Competencies

#### Precision Mechatronics

- High-speed and high-precision motion system design and control
- Data-driven control tuning

#### Industrial Robotics

- Robotic mechanism design, modelling and analysis
- Robot calibration and control
- Real-time control software architecture for robotic systems

#### Industrial Automation

- Adaptive grippers for material handling
- Simulation and design analysis

### Target Industries



Precision equipment and machine makers



Precision component and module manufacturers



Electronics and semiconductor manufacturers



Manufacturing, maintenance, repair and overhaul sectors of the aerospace and marine industries

# SUCCESS STORY

## Technology and Knowledge Transfer Leads to New Business Opportunities

The transfer of SIMTech's technologies and knowledge in mobile robotics equipped Aitech Robotics & Automation, a provider of robotics and automation solutions, with the required expertise and competencies in this area. Leveraging on the competencies they have developed and a queen bee-supplier matching enabled by SIMTech, Aitech secured business opportunity to implement their mobile robotics solution in the production shopfloor of a German multinational corporation. Since then, Aitech has secured six major clients in the private sector for the deployment of mobile robotics solutions.



“It was SIMTech that opened the door for us. In 2013, we partnered SIMTech for support in capability development, and the research institute linked us up with our first big client”

Mr Eric Lee, Aitech Robotics & Automation

## Technologies Available for Transfer

### Precision Mechatronics

- Data-driven autotuning
- Large travel range (few mm) ultra-precision (tens of nanometers repeatability) actuators
- 3 degrees of freedom (DOF) high-precision positioning systems: range 2mm, 5°; repeatability  $\pm 50\text{nm}$ ,  $\pm 0.5^\circ$
- Non-contact fragile handler
- Metrological characterisation and calibration of precision stages

### Industrial Robotics

- Calibration techniques for accuracy enhancement of robotic workcells
- Force-controlled multi-axis end-effector for precision deburring and profiling
- Robotic precision finishing systems
- Omni-directional mobile robots

### Industrial Automation

- Intuitive robot path teaching toolkits for welding, machining, and paint spray
- Welding process monitoring system for quality control
- Adaptive robotic gripper for machine tending
- Power assistive omni-directional wheel module for material transfer

## Research Partners

- Carnegie Mellon University (USA)
- Imperial College London (UK)
- Lund University (Sweden)
- Nanyang Technological University (Singapore)
- National University of Singapore (Singapore)
- University of California, Berkeley (USA)
- University of Delaware (USA)
- University of North Carolina at Charlotte (USA)
- University of Waterloo (Canada)

