

Active Upper Body Exoskeleton

Dual arm upper body exoskeleton for teleoperation

System Description

The active dual arm upper body exoskeleton is a human-machine-interface used for teleoperation of robotic systems in a safe and intuitive way with natural movements. The exoskeleton has five contact points to the operator and the kinematic structure follows the human movements of the arms and the torso. It transmits the movements to the target system and gives the operator a haptic feedback from the end effector. The kinematic structure has eight active degrees of freedom at each arm and four active degrees of freedom at the back.

Technical Details

- **Size:** 0.8 m x 0.87 m x 0.5 m
- **Weight:** 19.5 kg
- Medical power supply 48 V / 31 A according to DIN / EN60601-1
- 7 active DOF per arm, 4 active DOF at the back, 4 passive DOF and 5 DOF for length adjustments
- **Materials:** high tensile aluminum, carbon fire reinforced plastics, synthetics
- **Actuation:** rotative BLDC-HarmonicDrive actuators 5 – 60 Nm at the upper arm, linear Robodrive screw drive 790 N at the back, Dynamixel MX28 at the lower arm, Servomotor MKS DS 95 at the hand interface
- **Sensors:** 20 x iC-Haus MH, 29 x iC-Haus MU, 2 x Honeywell force sensor
- Communication network of three independent CAN-bus systems for control purposes
- In-house developed STM 32F4 microcontroller board for low-level-control
- In-house developed joint electronics, consisting of four PCB (power supply, FPGA, interfaces und sensorics, communication)
- 3-Layer control architecture. Robust cascaded velocity-torque control on the low-level, dynamic control and gravity compensation at mid-level, using the open source RBDL library
- Mapping of the movements via UDP protocol to different robotic systems is possible

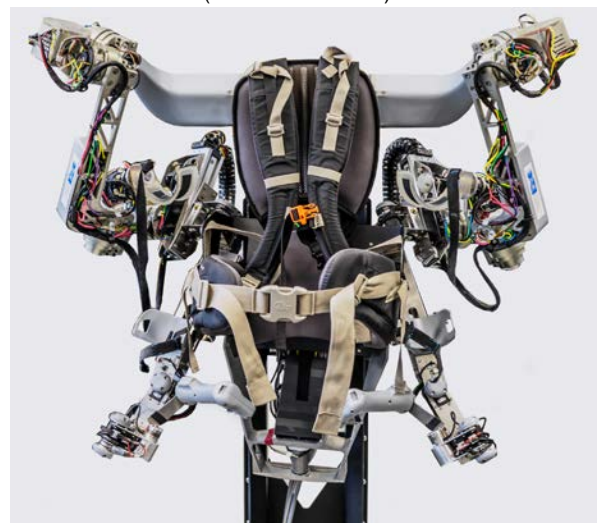


Teleoperation scenario: Remote control of the robot AILA

Application: Space robotics, Teleoperation

Projects:

- TransTerrA**
Semi-autonomous cooperative exploration of planetary surfaces with installation of a logistic chain and transfer to terrestrial usage under several aspects (05/2013 - 12/2017)
- RECUPERA-Reha**
Ganzkörper-Exoskelett für die robotische Oberkörper-Assistenz (09/2014 - 08/2017)
- CAPIO**
Dual Arm Exoskeleton (01/2011 - 12/2013)



The active upper body exoskeleton in its resting state

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