German Research Center for Artificial Intelligence

COMPI

Compliant Robot Arm

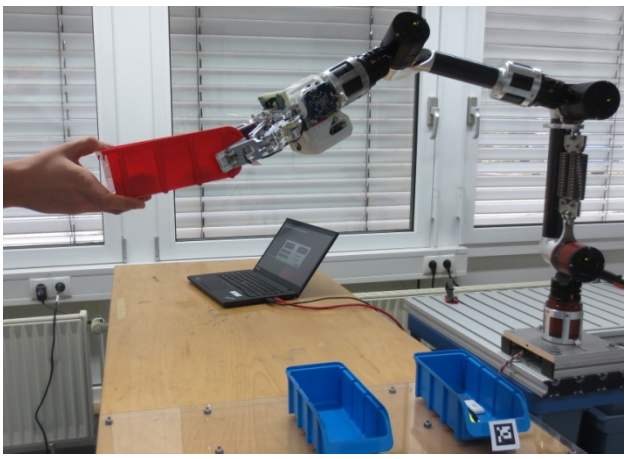
System Description

The robotic arm COMPI is composed of six rotational joints. Each of them is controlled by a FPGA, which implements different control modes. In particular, this system is used as platform to research dynamic control approaches.

Such control strategies play an important role for force- or torque-based tasks, e.g. in the field of Human-Robot-Interaction. The obtained results are continuously transferred to other robotic systems, which have similar kinematic structures as sub-system.

Technical Details

- **6-DOF Arm:**
  - **Size:** ca. 94 cm x 15 cm x 6.5 cm
  - **Mass:** ca. 4.75 kg
  - **Payload:** ca. 2 kg
  - **Sensors:** Joint positions (absolute and incremental); motor phase currents
  - **Six rotational joints:** BLDC-Drives, 1:100 Harmonic Drive Transmission
- **Self-adaptive gripper**
  - Adapts to various object shapes
  - **Sensors:** Time-of-Flight camera; RGB-camera; 4 tactile sensor pads; 5 position sensors; motor current
  - Control of gripping force, opening angle, and velocity via FPGA
- **Each actuator controlled by one FPGA**
  - In-house developed joint electronics
  - Control of position, velocity, and motor current
  - Different modi for higher level controllers
  - Switching and re-configuration during runtime
  - Intelligent intervention of controller ensures limitation of all control variables in every mode of operation
  - Integrated friction identification and compensation
- **Torque-based higher controller**
  - Based on identified dynamical model of the arm
  - Compensation of non-linear effects such as gravity and friction
  - Allows compliant control of the arm position



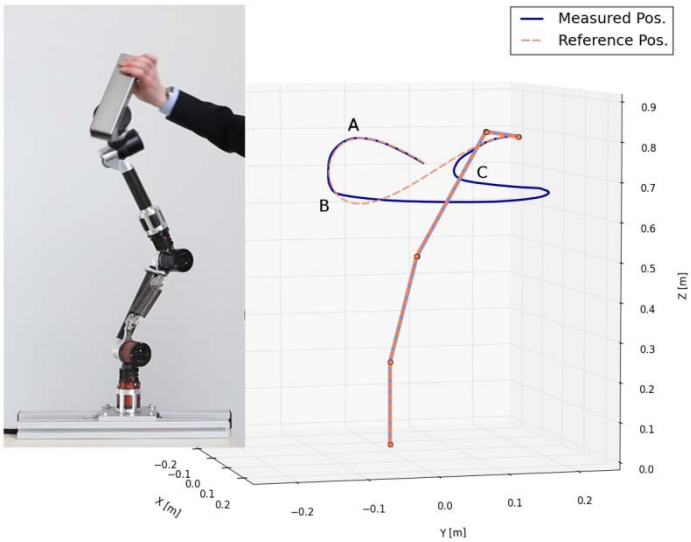
Robot arm hands objects to a human

Application: Assistance of humans in manual tasks in production or other environments; force-based control tasks

Projects:

HySociaTea
Hybrid Social Teams for Long-Term Collaboration in Cyber-Physical Environments
(09/2014 - 08/2016)

BesMan
Behaviors for Mobile Manipulation
(05/2012 - 07/2016)



Compliant Behavior: Robot arm tracks trajectory (A), reacts compliantly to temporary deflection by hand (B) and continues trajectory tracking (C)

Universität Bremen

Contact:
DFKI GmbH & Universität Bremen
Robotics Innovation Center

Director: Prof. Dr. Frank Kirchner
Phone: +49 421 - 178 45 4100
E-mail: robotik@dfki.de
Website: www.dfki.de/robotics