

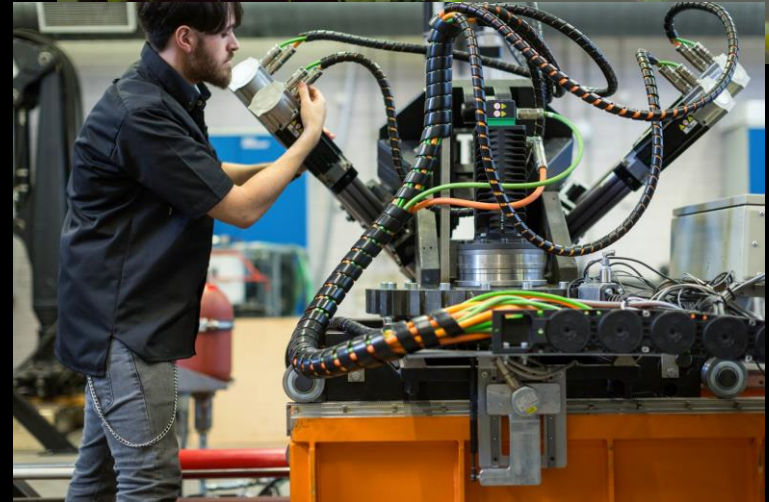


Research on Intelligent Machines in Department of Mechanical Engineering

Professor, D.Sc (Tech.), Heikki Handroos

LUT and Laboratory of Intelligent Machines

- **Founded 1969**
- **Located in South-Eastern Finland (around 6000 students and staff members)**
- **Faculties in Engineering and Business**
- **IM Lab is a forerunner in machine simulation and nuclear robotics**
- **Projects and start up in novel human-machine interface technologies (force, touch and vibration)**



Biography Heikki Handroos

- Prof. of Machine Automation and Head of Laboratory of Intelligent Machines since 1993.
- His research interests range from modeling, simulation and control of mechatronic systems to robotics, hybrid transmission and mobile machinery
- He has published about 240 scientific journal and conference papers in the field of mechatronics
- Supervised 19 Doctoral Dissertations
- Has been responsible leader of academic and industrial R&D projects (tot. > 15M€)
- Co-founder of MeVEA Oy, Haptronics Oy and the Human Touch Robotics
- Visiting Professor in University of Minnesota, National Defense Academy (Japan) and Peter the Great St Petersburg Polytechnic University
- Several Duties of Trust in ASME, IEEE and GFPS



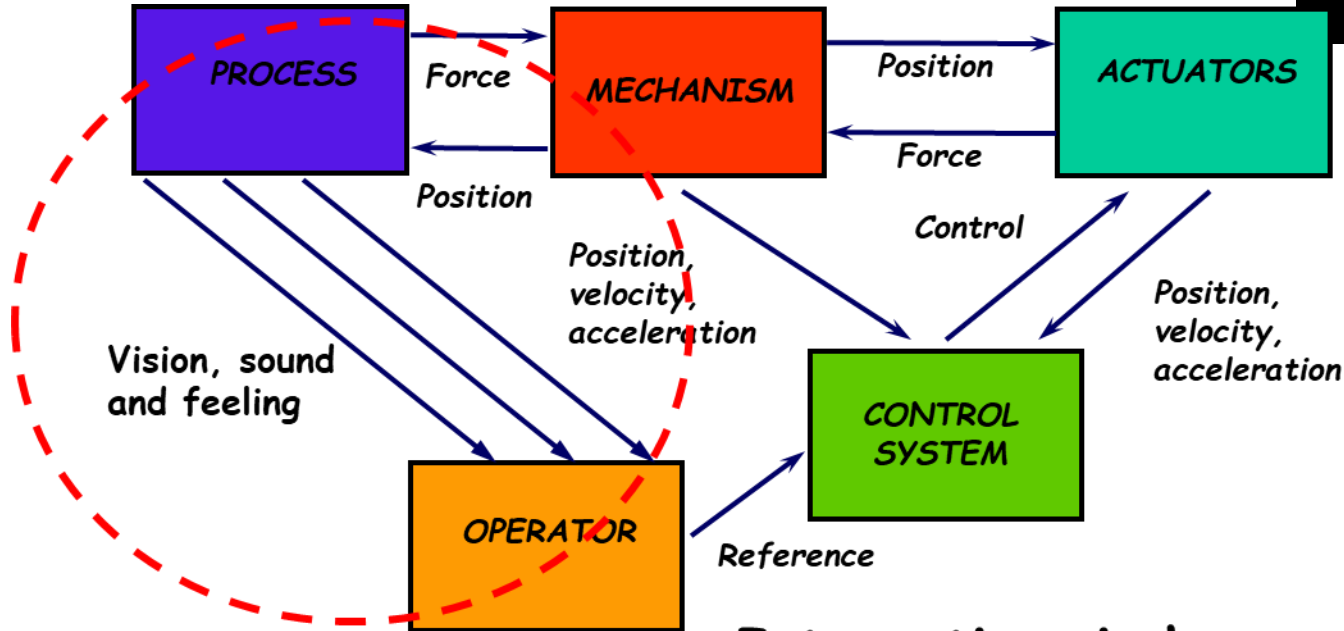
**Real-time
Physically
Realistic
Simulation**



Interconnections of Subsystems



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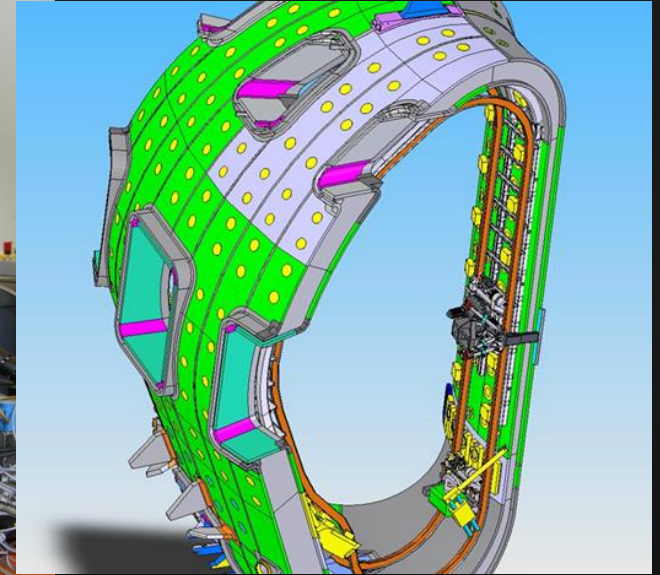


Interactions in human-machine systems

Parallel Robots for Fusion Reactors

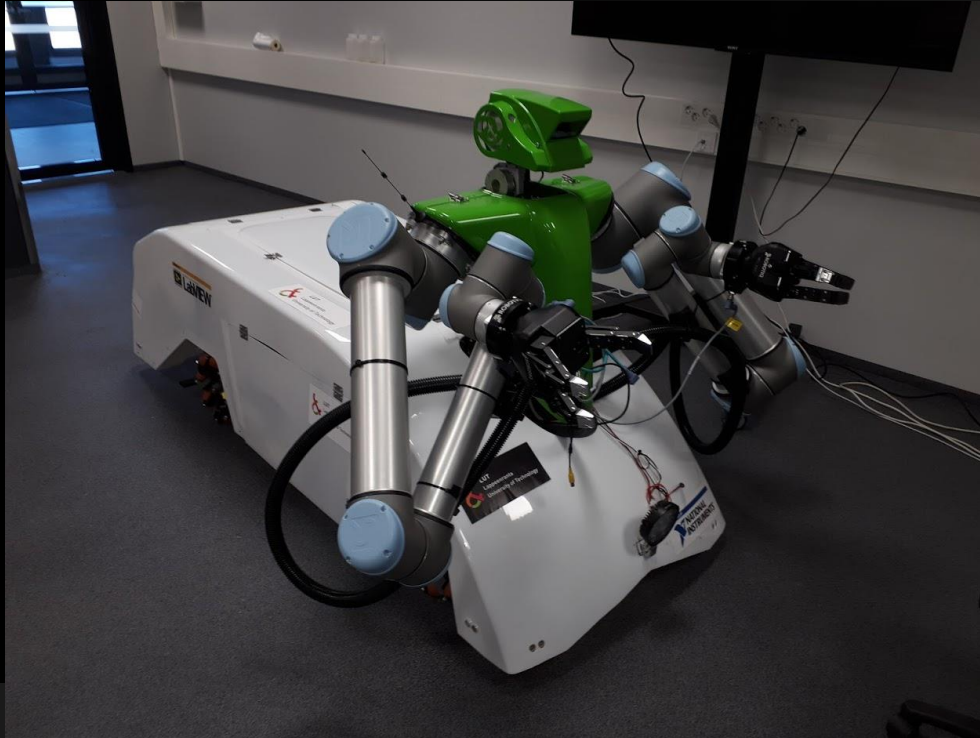


ITER and CFETR



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Mobile Robots for Remote Assembly



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Haptic interface development



Riding simulator with body measurement



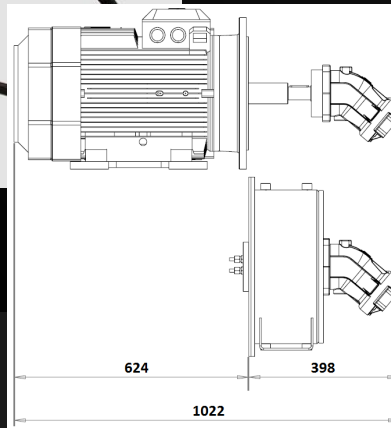
Parallel kinematic drill boom



Integrated Electro-Hydraulic Energy Converter – LUT IEHEC



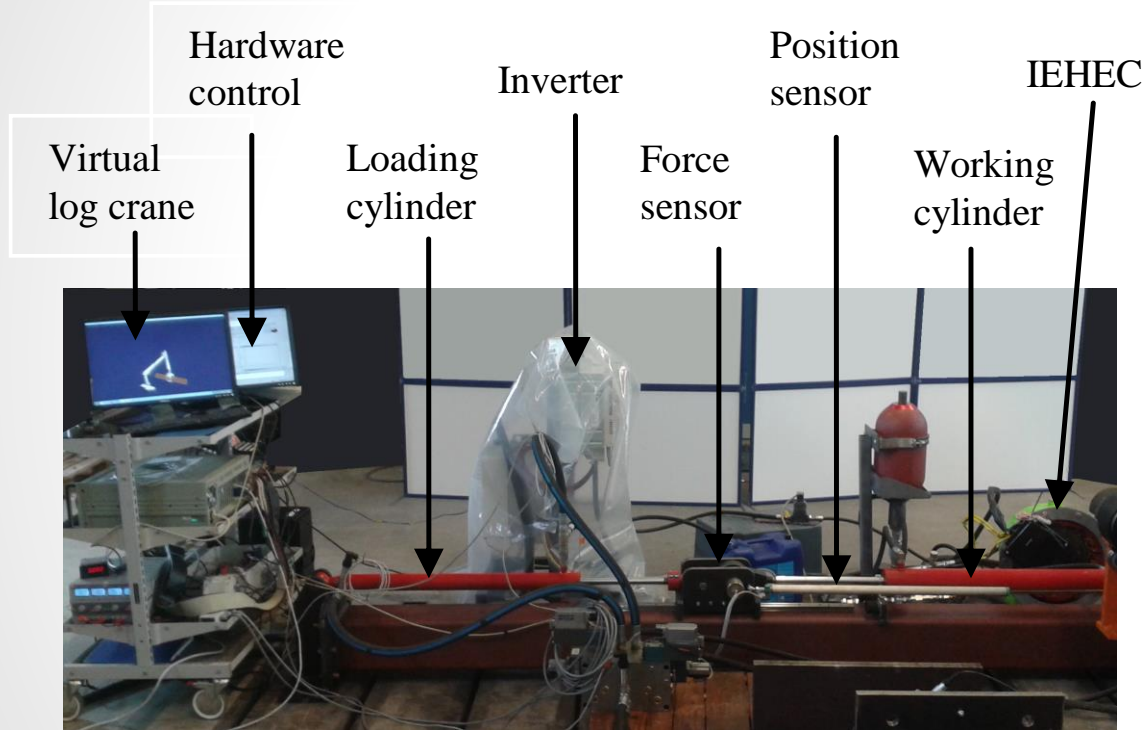
- Supplies hydraulic circuit with hydraulic power
- Energy regeneration (hydraulic energy → electrical energy)
- Maximum efficiency up to 90 %. Inverter efficiency is not included.



Parameter	Value
Output power	30 kW
Flow rate	100 lpm
Speed max	3000 rpm
Pressure max	380 bar
Weight	110 kg

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Hardware-in-the-loop simulation



Brain- Control robot for Rehabilitation and home care



EEG
Wireless
signal

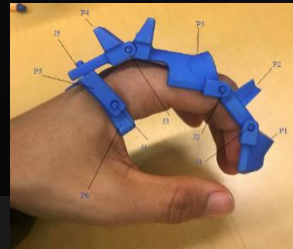


Real-time BCI
Decoding method

- Design, Printing and Successful Assembly of the skeleton
- Low cost robot glove for controlling the hand and fingers

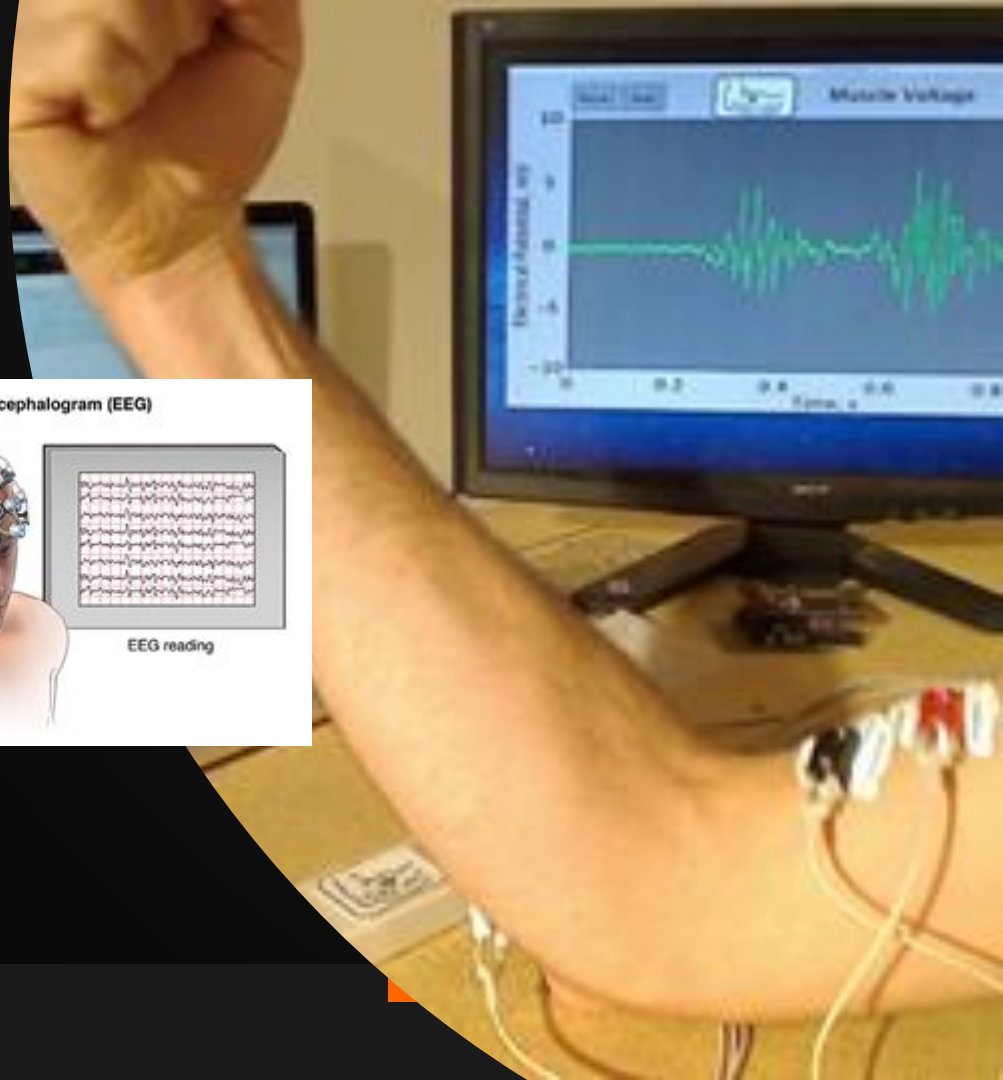
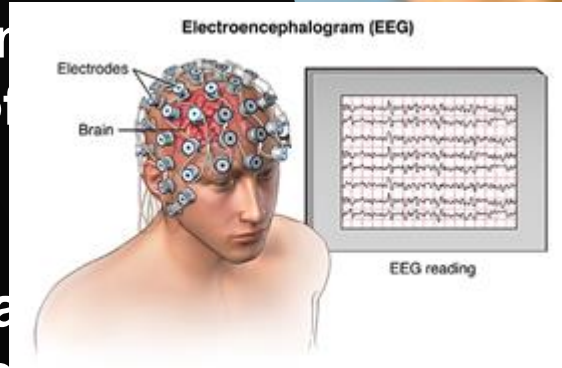


Control Wireless signal



HMI and usability optimization by human monitoring data and AI

User monitoring data (motion capture, muscular activity, EEG) is used in intelligent evaluation of usability of designs proposed by AI. Also HMI's can be taken as a part of the MBS assisted intelligent design processes. Test drivers physical and mental loading can be evaluated when driving



Thank you for your attention!

