

Future trends in virtual design of fluid power driven machines



Professor, D.Sc (Tech,) Heikki Handroos
Laboratory of Intelligent Machines



What are the Megatrends in Fluid Power Driven Machine Industry?

Hybridization of the transmissions



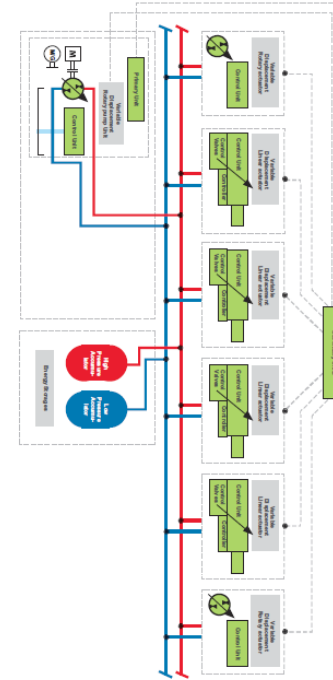
Hydraulic-
Electric

Hybridization



LUT Integrated
Electric-hydraulic
Energy Converter
IEHEC

Hybridization of Transmission



**NORR
HYDRO**
customer oriented innovations



Trends in Control

- Unmanned working machines
- Autonomous/ Remote operation
- Haptic feedback
- 360° Camera technology
- Augmented reality



Unmanned Machine Fleets



- Positioning
- Machine to Machine Communication
- IoT
- Logistics
- Artificial Intelligence
- Adaptivity



How do these megatrends challenge the design and development?



State-of-the-art

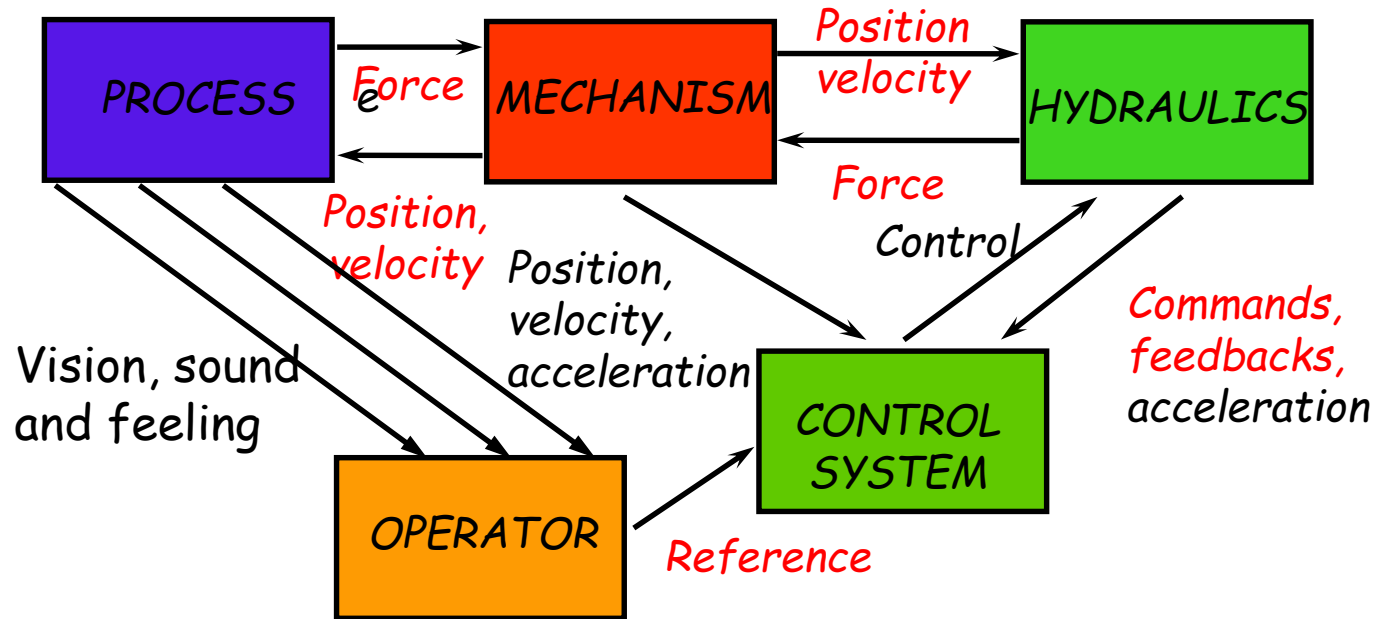
- Machines are designed individually by using commercially available software tools such as CAD, FEA, Off-line simulation
- Most advanced products provide 3-D visualization without physical functionality
- Physical prototyping has an important role in R&D processes - usability is tested by physical prototypes
- Real-time simulation is mainly used in testing the control software/hardware
- No virtual tool suitable for Internet-of-Things level design

State-of-the-art virtual reality tools

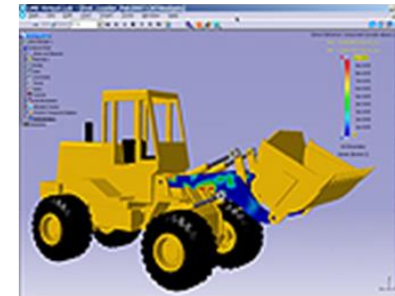
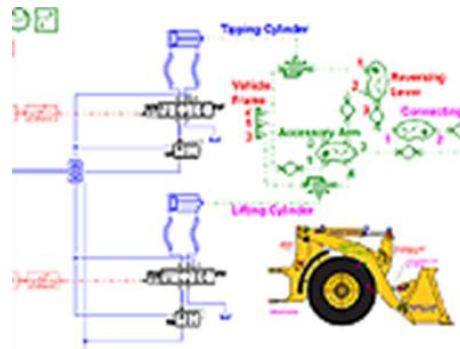




Physical Couplings in a Machine



State-of-the-art simulation tools





What do we need

- Physically adequate real-time simulators for simulating complete machines in realistic working environments to test:
 - Usability and Human-Machine-Interface before the first physical prototype is built by applying immersive virtual technology
 - Effects of individual drivers into safety, energy consumption and durability of the machine
- Internet based physically adequate tools for real-time simulation of machine fleets and entire production sites to test:
 - Design and optimize overall productivity of fleets
 - IoT software, hardware and smart sensor networks

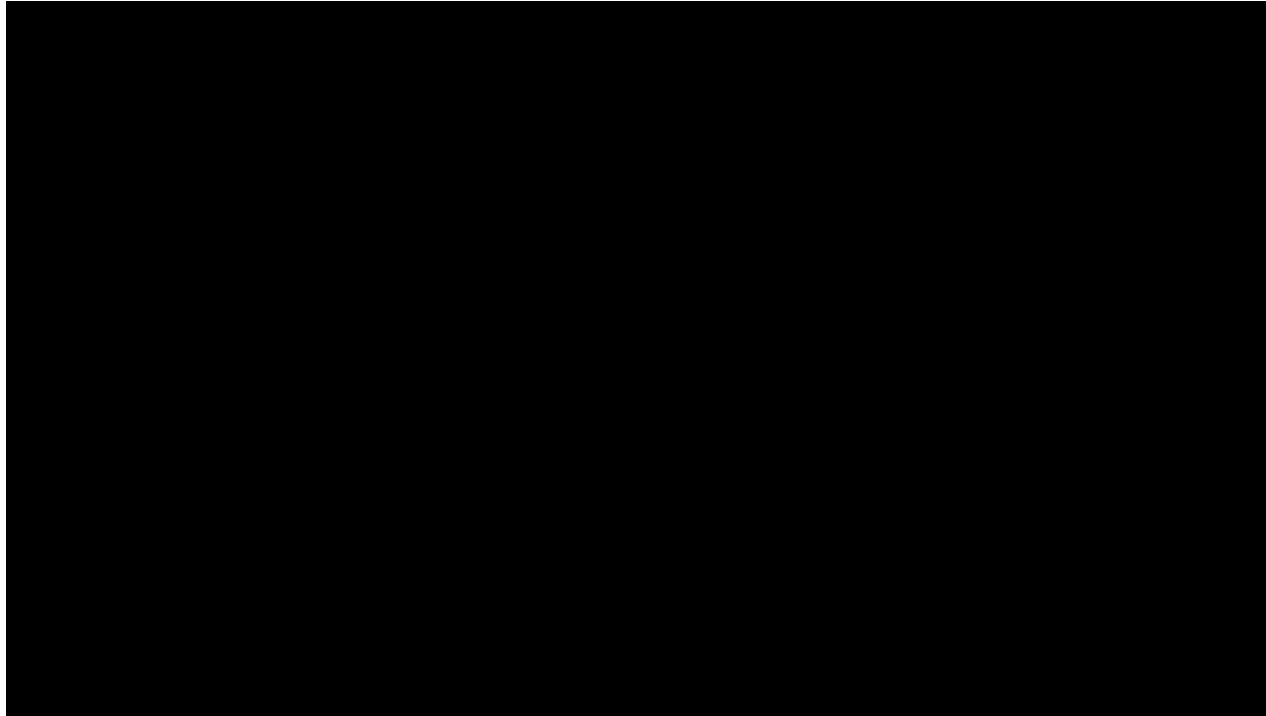
Single Machine Real-time Simulator with VR



Global Fleet Design Network



Machine Fleet RT-simulator with VR



- Concept developed by LUT
- Tool developed by Mevea Ltd.
- Delivery by the end of 2016

Thank you for your attention!



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