Robot control made easy

Haptic Shared Control for Space Teleoperation

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Start date: 1-5-2012
Funding: STW/ H-Haptics project
Cooperations: ESA ESTEC (TRH Lab)
Type: Engineering

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Background

Some tasks are still too hard to be automated

Despite progress in robotics and automation, variability of many tasks require to keep the 'human in the loop'.

But 'classical' teleoperation comes with high workload

Currently, to integrate all the sensory information from the remote environment, the operator needs to continuously monitor several video screens and conduct taxing mental transformation.

The distance makes the space teleoperation even more challenging

The long distances involved in space teleoperation are associated with substantial time delays and with rather limited communication bandwidth. This is not only problematic for the operator to cope with but also requires special attention during system design to ensure system stability and safety.

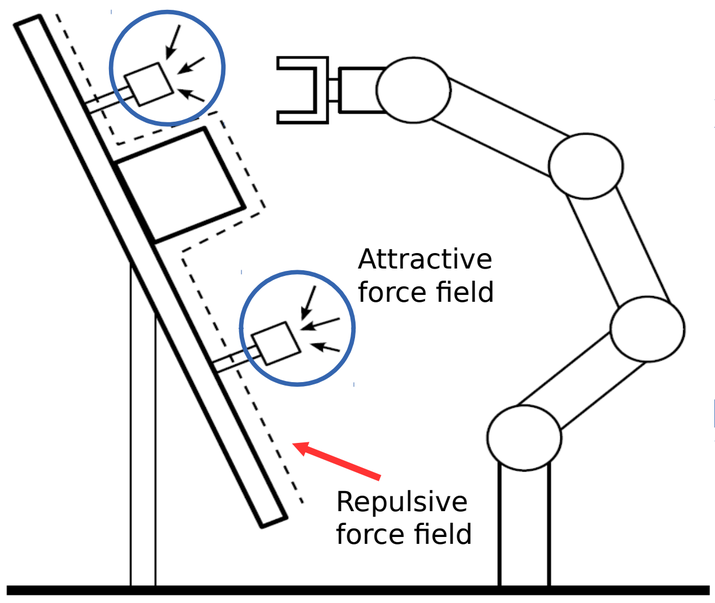
Concept

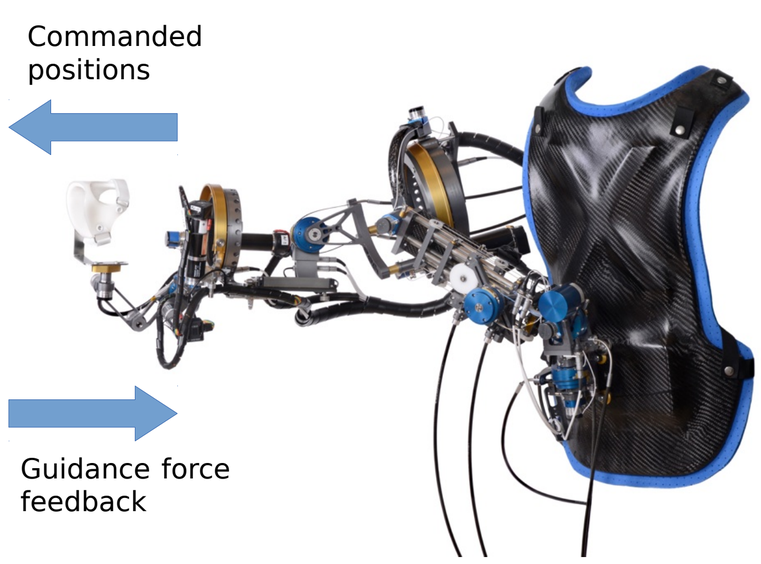
Provide additional support to the operator

As an example, sensitive parts of the environment could be protected with a virtual 'repulsive field' or the operator can be guided towards an object to be picked-up with an attractive field.

Use forces to communicate the actions of the automatics system

In Haptic Shared Control, the actions of the human operator are combined with the input of the automatic system using additional guidance forces on the control input device. This way, the operator still holds the ultimate control authority and is also always aware of the actions of the automatic system.





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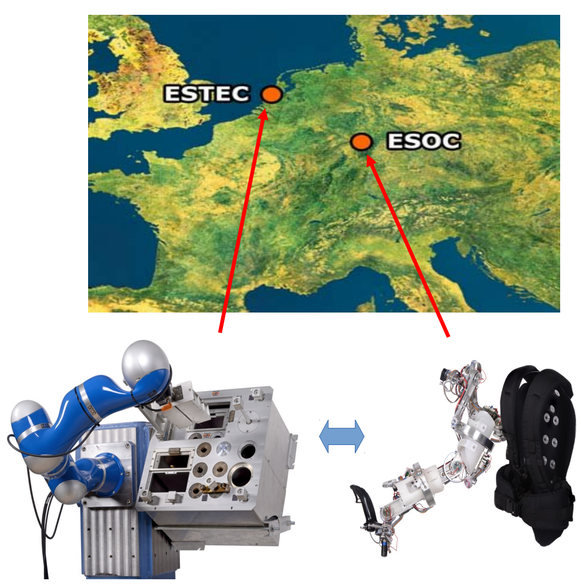
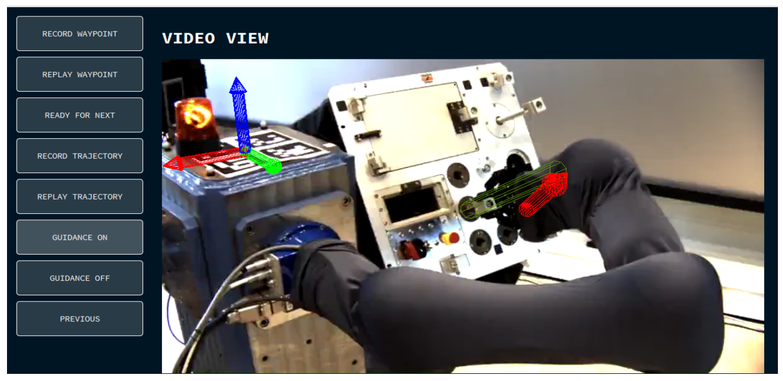
Experiment: Using an exoskeleton to control a robot from a different country (bilateral teleoperation with force feedback over 500km)



The robot and the operator were 500km apart, communicating through standard mobile phone connection with limited bandwidth and variable delay (100-800ms). Despite that the system works well enough that we were able to perform a non-trivial task, live for a TEDx talk audience (it is on youtube).



Possible MSc thesis topics

Following is an example of two currently available topics:

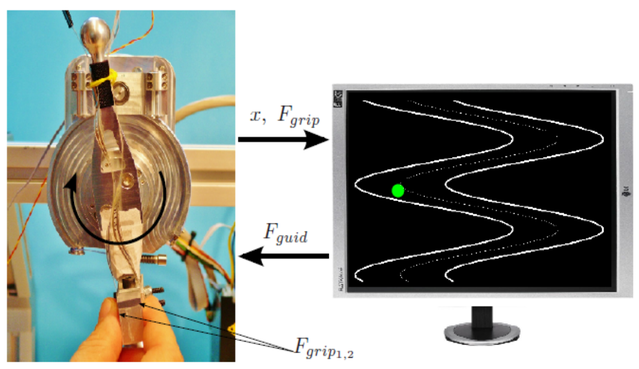
Design and validation of task specific HSC for remote assembly

Integration and optimization of a 3D camera into the teleoperation work-cell

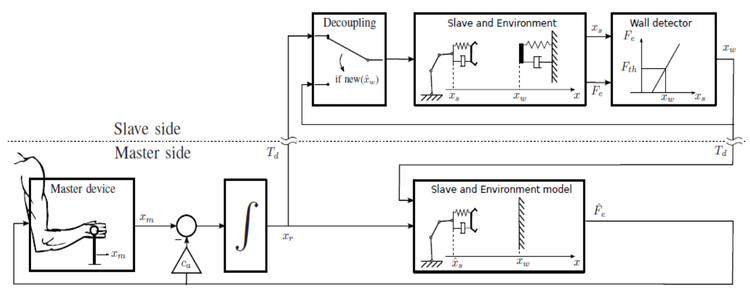
There are several possible directions in the projects based on prospective student's background and preferences, ranging from 'theory' focused work to more complete assignments that should be validated using human-in-the-loop experiments on the teleoperation setups available at TU Delft or in the Telerobotics and Haptics Lab at ESA ESTEC.

Publications

J. Smisek, W. Mugge, J. B. J. Smeets, M. M. van Paassen and A. Schiele, ***Adapting Haptic Guidance Authority based on User Grip***, IEEE SMC 2014 (submitted)

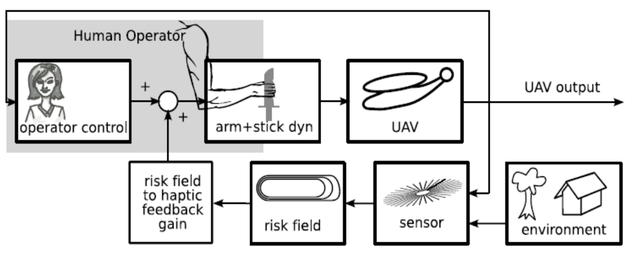


J. Smisek, M. M. van Paassen and A. Schiele, ***Rate Control Model-mediated Teleoperation Using Impedance Controlled Slave for Robustness Against Substantial Time Delay,*** IEEE SMC 2014 (submitted)



J. Smisek, M. M. van Paassen, D. Abbink and M. Mulder**, Neuromuscular analysis based tuning of haptic shared control assistance for UAV collision avoidance,** IEEE WHC 2013

E. Sunil, **J. Smisek**, M. M. van Paassen and M. Mulder, ***Validation of a Neuromuscular Analysis Based Tuning Method for Haptic Shared Control Systems***, IEEE SMC 2014 (submitted)



TU Delft Delft University of Technology

TRH lab

esa

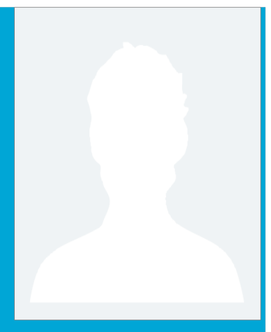
HAPTICS

Challenge the future

Aerodynamic study of micro-aerial vehicles

(Title: Bookman old style 66pt)

PhD Candidate: Mustafa Percin
Department: C&O
Section: Aerodynamics
Supervisor: B. van Oudheusden
Promoter: F. Scarano
Start date: 10-5-2010
Funding: STW
Cooperations: AGARD-NATO
Type: ☐ Engineering ☐ Scientific



Background

The use of unmanned aerial vehicles has largely increased in the last decade due to advances in manufacturing and flight control technology…

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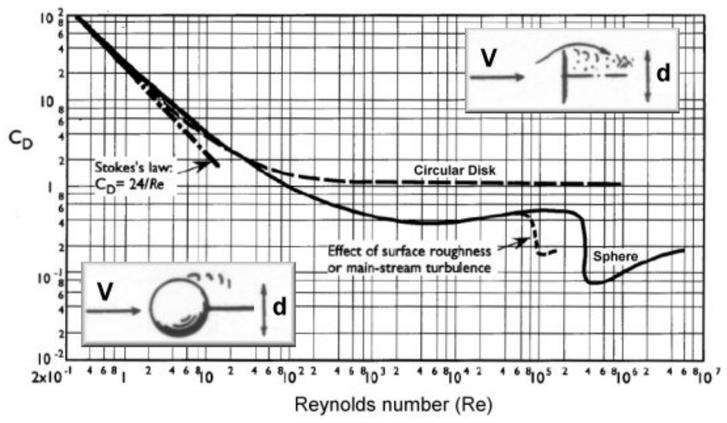
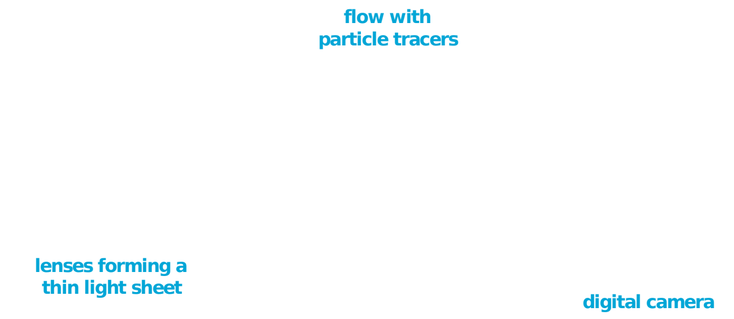
Body text: tahoma 18, paragraph justified, single line spacing

Example of very large micro-aerial vehicle

Heading 1

Text, figures, equations, diagrams…





A laser system to measure the flow around a MAV

Progress and Objectives

A great deal of progress was obtained to my own judgment. According to my supervisor, the progress was just enough to pass the GO-NO-GO

Publications

- A.B. De Groot, C. ter Midden, D Klein, (2010) “On the stability of a clap and fling mechanism”, *Journal of Micro Aer vehicles* **12**, pp 24-38
- E.G. Hooghuis, F. Baraque, (2012) “A plasma actuator for MAV flight control”, Journal of Physics **81**, pp 112-141
…

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