# Tele-Kinesthetic Teaching of a Humanoid Robot with Haptic Data Acquisition

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## Objective

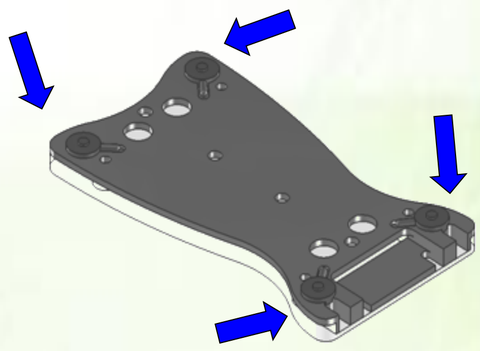
Collect data to teach a humanoid robot to perform specific motion tasks by demonstration, such as manipulation, balance and walking in a diversity of situations.

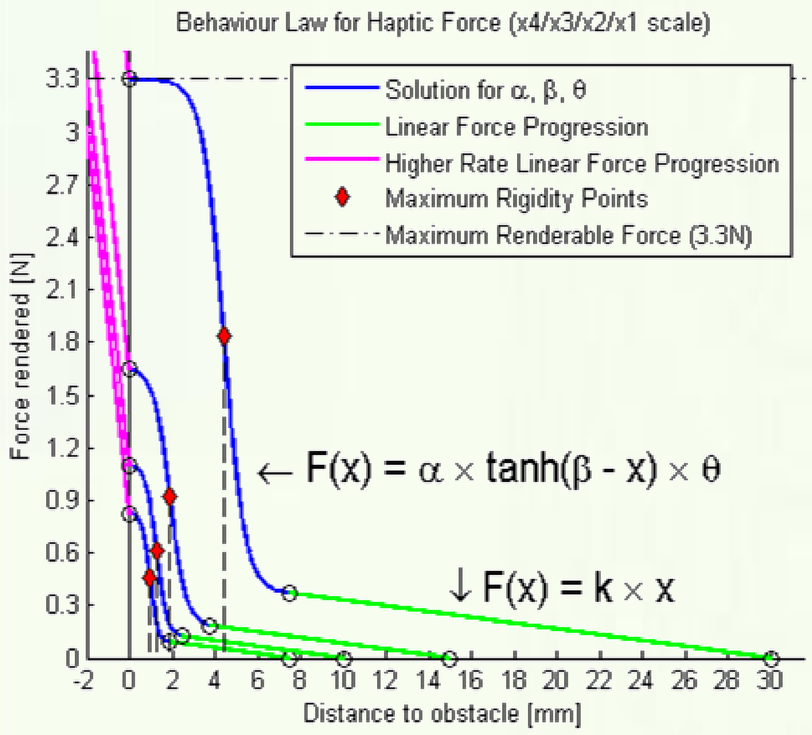
## Methodology

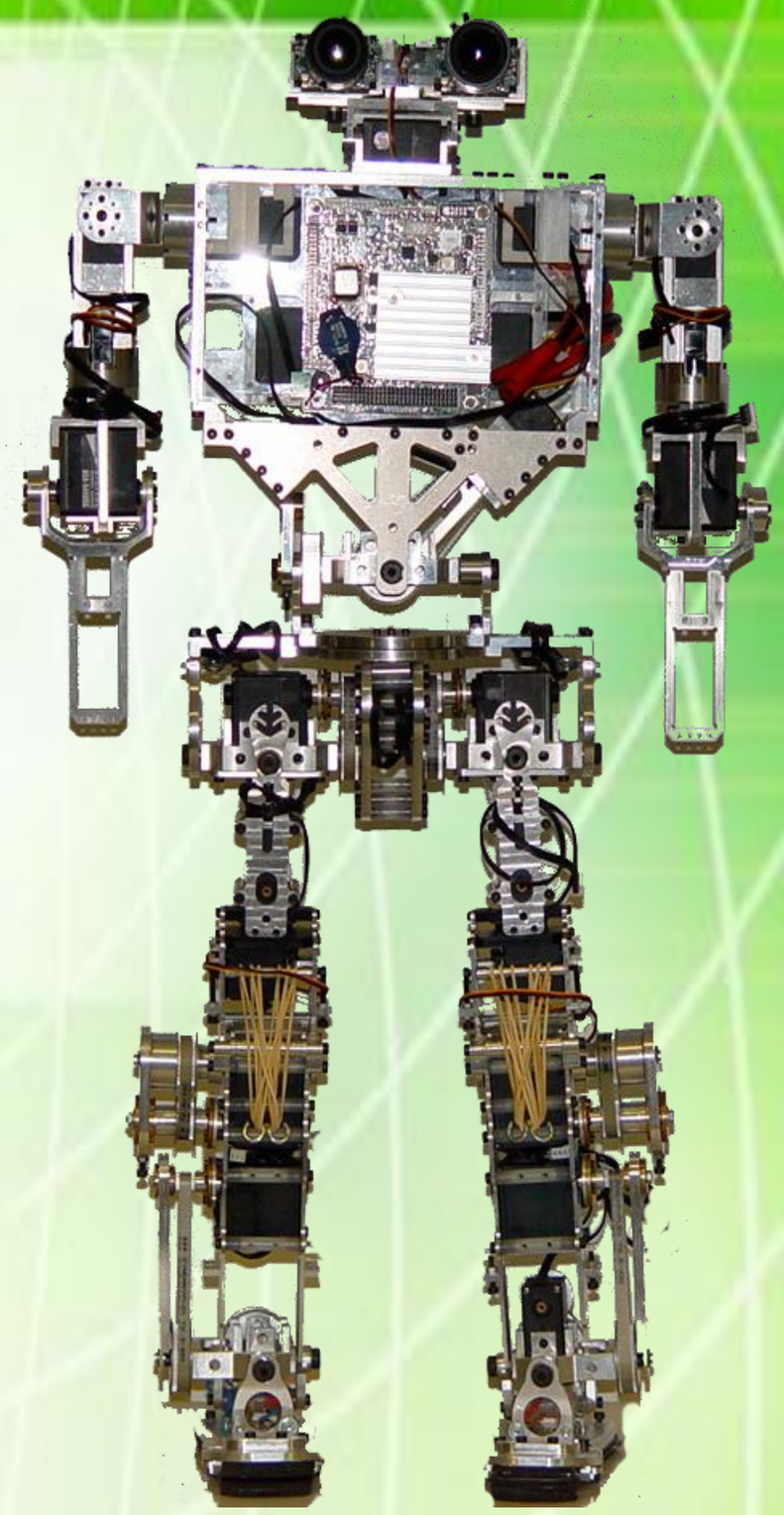
- Human teleoperates a humanoid robot with haptic feedback signals reflecting the robot's proprioception, allowing a "real feel" experiment.
- Once a trained user obtains good teleoperation performances, data logging of user commands and robot's own sensors are carried out for learning purposes.

## Tools

- PHANToM 6DOF haptic joystick
- Proprietary 25DOF humanoid robot
- Force sensors in the feet
- Inertial sensors in the body

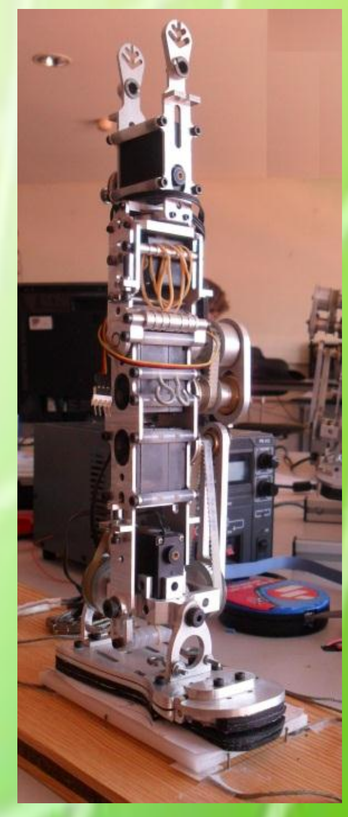


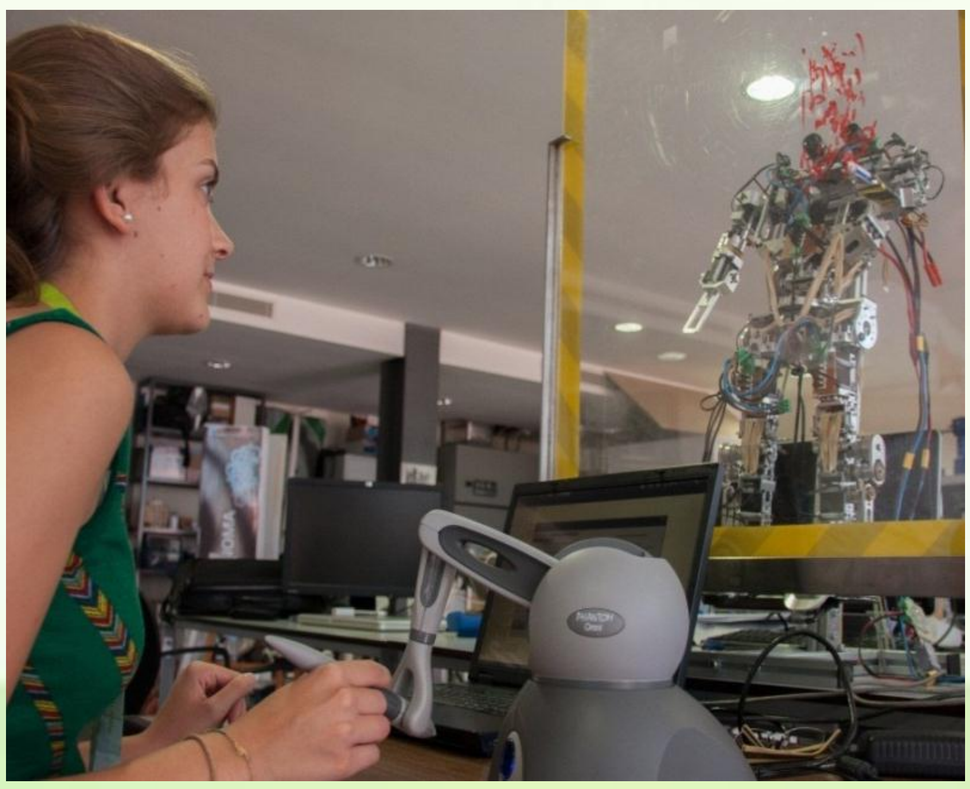


## ◄ Force simulation

Some information may be simulated to enrich a data set for future training: simulating workspace limits is one of such cases where situations of simpler kinematics and dynamics can be used to generate virtual forces and enrich user feedback.





## ◄ Experiments with force feedback

Teleoperation of robot arms to write with a pen on a transparent board, virtualized as an haptic object.

## Balance of a single leg ►

Teleoperation of a single leg with haptic feedback informing the user on the leg's center of pressure.

## Conclusions

- The proposed approach for tele-kinesthetic teaching of a full-body humanoid robot is based on a haptic interface.
- The feedback from the robot during the demonstration means that the teacher is able to feel the dynamics of the system.