H2020-NMBP-TR-IND-2018-2020 / H2020-NMBP-FOF-2019 (869963)

MERGING PROJECT

MANIPULATION ENHANCEMENT THROUGH ROBOTIC GUIDANCE AND INTELLIGENT NOVEL GRIPPERS

TRAINING MATERIAL
WP4 – FOAM BLOCKS & FRAGILE OBJECTS COMANIPULATION

Comanipulation of foam block with precision mode

Objective of the module

- This mode allows to transport and position foam blocks with a comanipulation system (robot/human dyad)

- It has been designed to fulfill these requierements:
  - *to ease the manipulation and precise positioning of large part by allowing more points of control of the part*
  - *to minimize the effort applied on the fragile part*
  - *to minimize the effort applied by the operator*
  - *to be used by robotics non-expert*

Comanipulation of foam block with precision mode

Presentation

- **The design of the controller fulfilling all the previous requirements is a mix of teleoperation and cobotics modes.**
  - The cobotics mode is realized with a force mode : the operator can directly move the object and the robot by applying effort.
    - *It can be done for instance with a force servoing control or with passive joint*
  - The teleoperation mode is realized with a velocity/position mode: the operator uses an external device to move the object and the robot
    - *In the Merging Project, the external device is a 3D spacemouse*

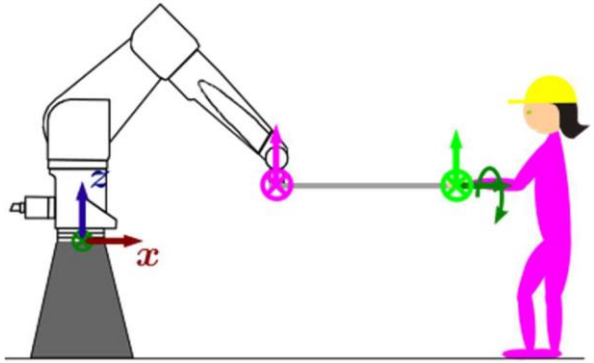
Comanipulation of foam block with precision mode

How to choose the degree of freedoms to be controlled in a cobotics mode and the ones to be controlled in teleoperation mode?

- **The force mode allows the motion of the operator gripping point: the rotations of the robot's wrist are free in order to avoid any torque application at the robot's gripping point and in order to let the operator position easily his gripping point (in green)**

- **The shared direction, which is the direction through the both gripping points, can be free because the force applied at the operator gripping point in this direction does not generate torque (in dark green). It can also be controlled by velocity/position mode when the robot is inertial and has non negligeable friction**

- **The velocity/position mode handles the remaining robot gripping point motions: the two other directions of translation (in magenta). It avoids the torques application at the operator gripping point.**



cobotics
teleoperation

In green, the degrees of freedom that are piloted in a force mode.
In magenta, the degrees of freedom that are piloted in a velocity mode with an external device.
In dark green, the degrees of freedom that we can choose to control either in a force mode or in a velocity mode

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How to use the spacemouse?

- **The spacemouse is wireless.**
- **The dongle needs to be connected on the controller**
- **The operator just push the spacemouse in the direction he wants to move the object and the robot**

To go bottom

To go up

To go on left

To go on right

Comanipulation of foam block with precision mode

How the operator can communicate with the DOHC?

- **The operator can use the button on the spacemouse in order to inform the DOHC to grasp a foam block or to release it when he decides that he has successfully achieved the positioning of the foam nlock into the mould**

Comanipulation of foam block with precision mode

- Example of use