Transfer Functions

A sophisticated interaction technique is strongly dependent on the properties of the input device and the applied transfer function (see Figure 1). Input devices can provide isotonic or elastic/isometric input. In this assignment you will work with a Gyromouse handheld device (see Figure 2) as a representative for isotonic input. It measures angular velocities in two degrees of freedom (DoF), in particular rotating left/right and tilting up/down. Alternatively a mouse device can also be used for the isotonic input condition. The 6DoF Spacemouse device (see Figure 3) provides elastic input for translation and rotation as well.

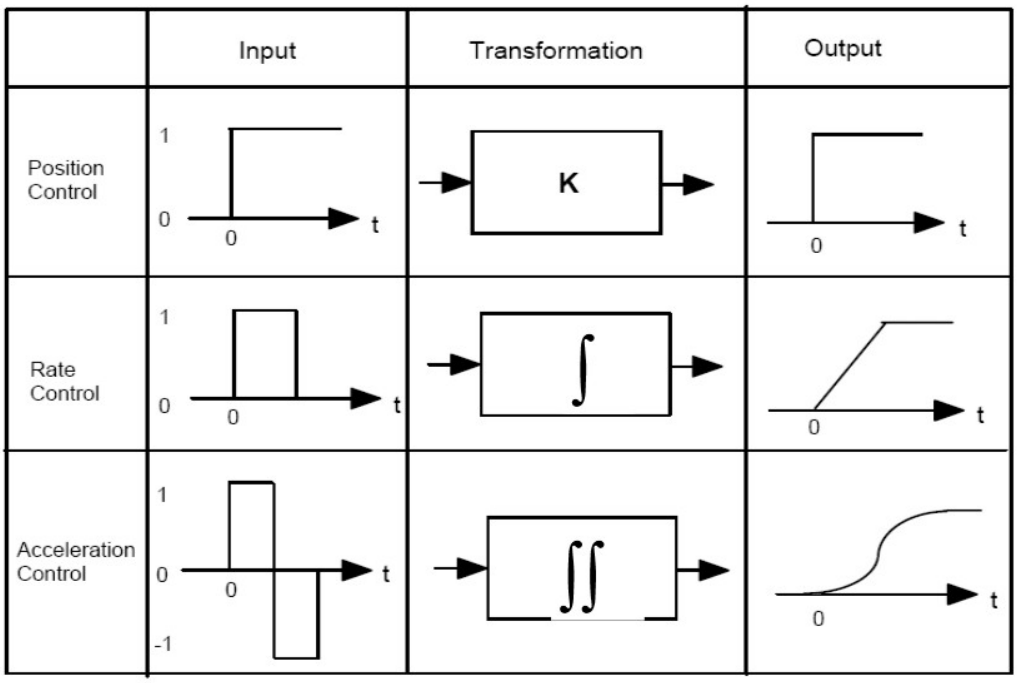

Figure 1: Idealized control inputs (left column) for obtaining step changes in output level (right column) for position, rate and acceleration control.

Isotonic Input

Figure 1: Gyromouse provides 2DoF by measuring relative angular velocities (tilting left/right, up/down).

Elastic Input

Figure 1: Spacemouse provides absolute input on six DoF.

The *transfer_functions* example implements a spatial manipulation task, where multiple target objects have to be selected and moved with a virtual hand using *isotonic* and *elastic* input devices in combination with different transfer functions. The resulting six input-type <> transfer-function combinations are assigned to the keys 1-6 on the keyboard. The application includes classes for data acquisition, data preparation and input mapping. The class *ManipulationManager* initializes and administrates the six manipulation techniques. The specific manipulation techniques are derived from the base class *Manipulation*. The respective behavior of each manipulation technique is implemented in the function *manipulate*, which is executed every frame. The *IsotonicPostitionControlManipulation* is already given and can serve as reference implementation for the remaining techniques.

How to start?

- Copy the *05_transfer_functions* folder from */opt/vr_exercises/WS_15_16* to a local repository
- Execute the *evtest* program to check the connected input devices. Have a look at the input values of the Spacemouse and Gyromouse.
- Execute the application by running ./start.sh in a terminal
- Proceed with the assignments
- A summery on device types and control functions can be found here: http://www.billbuxton.com/input08.HumanPerformance.pdf

Assignment Tasks (**graded**):

The maximum number of students per group is two. The presentation of the results takes place on **Friday 11.12.2015** in the lab class.

1. **[30%]** Implement a *rate-control* and an *acceleration-control* transfer function to move the virtual hand inside the scene with an *isotonic* input device. Adjust the input scaling factor or insert additional storage variables if required.
2. **[45%]** Implement a *position-control*, a *rate-control* and an *acceleration-control* transfer function to move the virtual hand inside the scene with the elastic input device. Adjust the input scaling factor or insert additional storage variables if required.
3. **[10%]** Asses the usability of each of the six the input-type <> transfer-function combinations in the context of precise object manipulation. Come up with suitable use cases for each of the combinations. Think in the scope of object manipulation as well as camera navigation.
4. **[15%]** Implement a *non-isomorphic* input mapping for *isotonic position-control* as well as for *elastic rate-control*. The functions should facilitate both precise (pixel wise) manipulations as well as rapid movements. Appropriate functions (trigonometric, power etc.) can be found in the python package *math*. Keep in mind that non-isomorphic transformations have to affect the whole translation vector and not a single component (direction of movement vector has to remain the same).