# Introduction Control technology

The aim of the lab is to make the ping pong ball float in a controlled manner in the tube. So, it must hover stably at a set height by controlling the speed of the fan. For this, the speed of the fan will have to be continuously adjusted, depending on the current height, so that a constant height is maintained. For this we have to use control techniques.

A system in which we compare the output (here: the height) with the desired value, and vary the input (here: the speed of the fan) based on that, is called a closed control system. As a block diagram it looks like this:
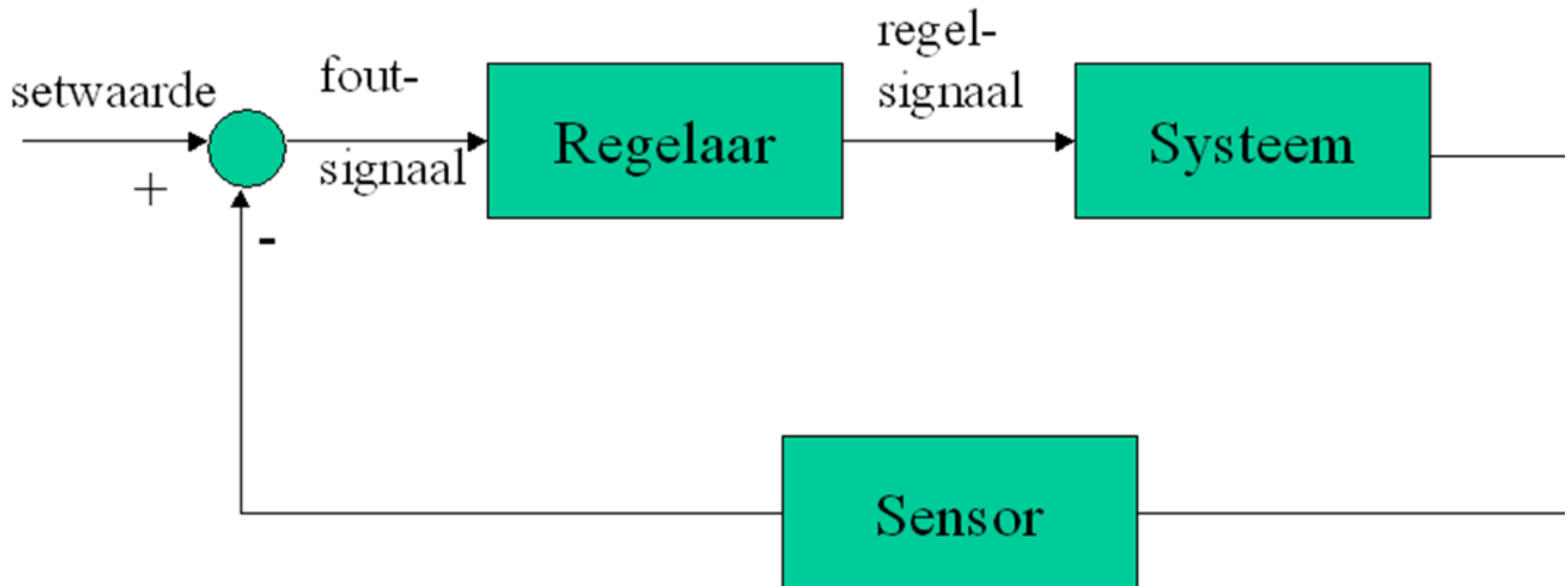
Watch the following video for an intuitive explanation of open and closed control systems.

Control Systems Lectures - Closed Loop Control by Brian Douglas

Control Systems Lectures - Closed Loop Control

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Controller types

The question remains, however, what exactly this controller is. The simplest way of controlling that we can think of is turning the fan on and off; this is called a bang-bang controller. Thermostats often work according to this principle: if it is too cold, the heating switches on, if it is warm enough, it switches off again. This way of controlling is simple to perform and can offer reasonably good performance. However, switching on and off continuously is detrimental to, for example, failures on the power supply, and this leads to wear and tear.

A more advanced way of controlling is done with linear regulators. The most commonly used variant of this is the PID controller, which is the de facto standard in the industry. To see how this works, watch the following videos:

# PID Control - A brief introduction by Brian Douglas

PID Control - A brief introduction

Continuous Cycling Method (Ziegler-Nichols Method) by LearnChemE

Continuous Cycling Method (Ziegler-Nichols Method)

Tip : the Laplace transforms are often used in the block diagrams. So the integral becomes 1/s, and the derivative (differential) becomes s.

The diagram of the PID controller is mentioned again here:
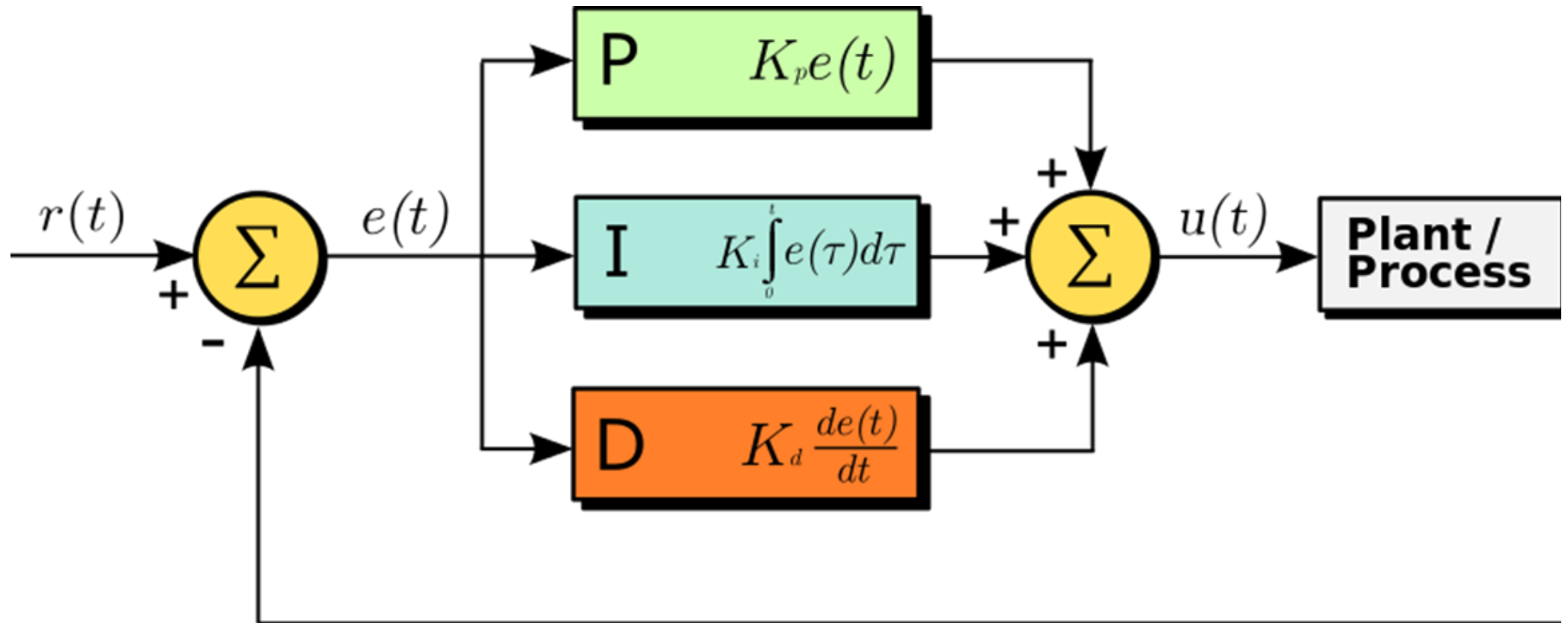
Conclusion

You now understand how a control system works and you know the basics to regulate it stably. We can now put the control system into practice to control the height of the ball.

In the next two technical manuals you will learn how to do this with an analog and digital circuit.