

## INCASE MISSION

Within the world of Industry 4.0, we develop test set-ups and demonstrators for sustainable technologies to prove the viability and applications of this technology. We introduce the technology to the industry by means of workshops and lectures based on own research and experience.

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Project

# Co-simulation

## How can we make moving applications run as effectively as possible?

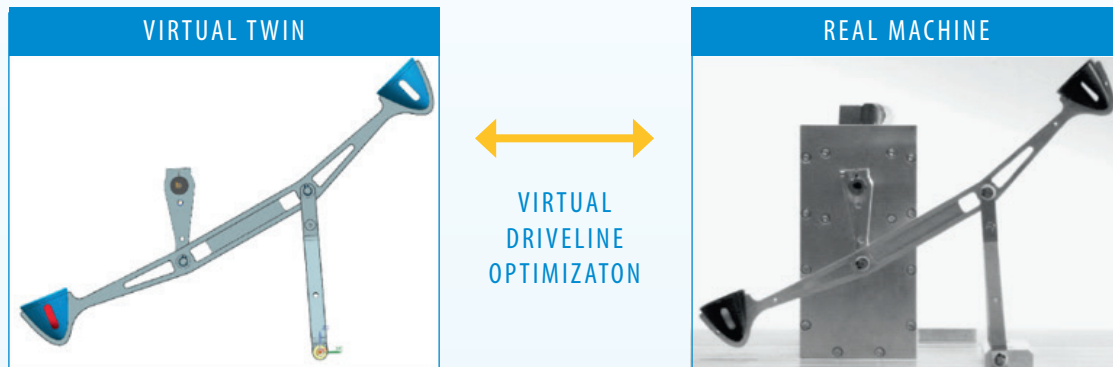


### What

We want movements in machines to be as effective as possible.

By effective, we mean as energy-efficient and as fast as possible. In other words, how can we use the smallest possible - and therefore the cheapest - machine in dimensioning. Or how can we make a process run as effectively as possible to reduce energy consumption or carry out a particular operation quickly.

The applications were optimised using co-simulation. Co-simulation lets different software packages, such as CAD packages and control engineering packages, work together to optimise the design virtually.



### Pilots (applications)

UGent has developed five different configurations to demonstrate the possibilities of co-simulation. An excellent example of this is the ball juggler, which is a machine that juggles balls. To do this properly, four parameters need to be defined: the starting angle, the speed of throwing a ball, the heading angle, and the catching angle. This can be done with trial & error or by simulation. We used simulation.

**How?** We drew the entire system in a CAD package (Siemens NX) in which moving systems can be represented (i.e. no static drawings).

Then we used co-simulation to link the CAD package to mathematics software. The mathematics software calculates the behaviour of the moving system to obtain the correct settings for the four parameters. Therefore, co-simulation is the combination of two software packages to achieve optimisation. Once we have the right parameters (the correct speed and angles), we can automatically generate the necessary code for the controller.

UGent developed two of these ball jugglers, each with different complexities. Another application is a Kuka robot, an industrial application in which we outline the most effective trajectory for the robot. The third and fourth industrial applications from the textile and metalworking sectors ensure that the machine is dimensioned effectively. By adjusting the speed and acceleration of these machines, we reduced energy consumption by up to 20 % so that a smaller drive motor could be used.



## Conclusion

Apart from the two ball jugglers that demonstrate the basic idea of co-simulation, we also examined three industrial applications. The first industrial application was about trajectory optimisation (= time gain); the other two were about torque optimisation (= limiting peak load to more effectively dimension the motor and reduce energy consumption). The biggest advantage? Doing everything through simulation means that the settings of the motion systems are immediately correct, avoiding a lot of iterations.



## Number of companies reached through workshops and lectures

We delivered various workshops and lectures on this theme and reached 173 unique companies and 336 people.

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