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Container Unpacking

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Copal Handling Systems, headquartered in the Netherlands, develops and manufactures container-unloading and palletizing systems. With these unique and innovative systems, floor loaded containers can be unloaded without any physical effort. Controllab was asked to analyse the CopalC2 robot and improve the motion control of this robot to increase its speed of operation.

C2 Robot

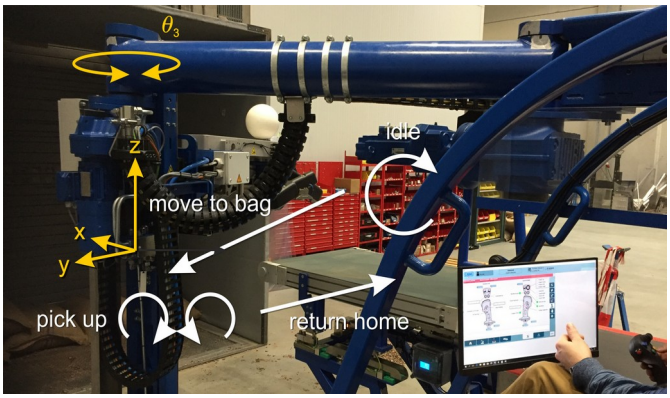
Manual loading and unloading of containers is labour intensive and subject to ever stricter regulations related to lifting weight. Therefore Copal has developed the semi-automatic C2 robot. The C2 robot is hand operated and allows you to unload without heavy physical work. The C2 robot is applied successfully in many factories. Manual operation is monotonous work. A survey amongst customers showed that there is a strong business case for an automated C2 robot. Therefore Copal started a project to automate the C2 robot.

The first part of the automation was the automatic detection and localization of products (e.g. bags) in a container. A laser scanner, implemented by the company Pliant was successfully tested early 2018. The second part of the automation, was the automatic motion of the robot to and from the products. A first test with bags loaded in a container, showed that the robot was too slow. Controllab was asked to analyse the robot and come up with a solution.

Model Based Design

The automation of the C2 robot consist of a set of tasks which are carried out in succession: wait for the product to be located, move to the product, pick it up, return the product to the conveyor and release the product. The movement is the most complex task. The motion from the current position to the position of the product, has to be translated into the individual motions of the robot arms. The robot has seven degrees of freedom, which means that every motion can be carried out in multiple ways.

Controllab created a simulation model of the C2 robot to analyse this movement. The model contains all of the physics of the robot (arms, gearboxes, motors) and the motion control. The model is coupled to a VR environment, to show the robot action during a simulation.



The first simulations showed that the motion was not optimal. The robot arms were moving in such a way that the individual motors were overloaded. A better motion strategy could reduce the individual motor loads significantly.

An improved motion control, using the new strategy was implemented in the model. Numerous simulations were carried out to verifiy the robust and stable operation using the new strategy. Simulations showed that a significant increase of the robot speed could be obtained, leading to a significant decrase in cylce time.

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