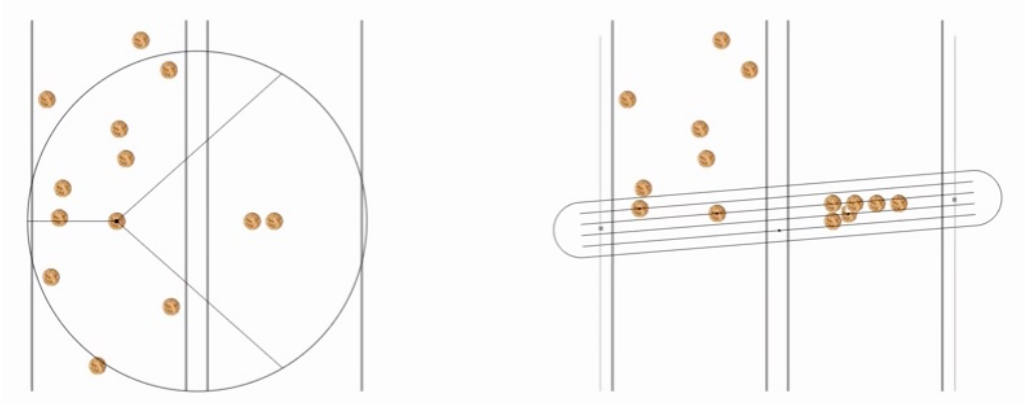
Optimal Pick and Place Strategy for an Isochronic Robot

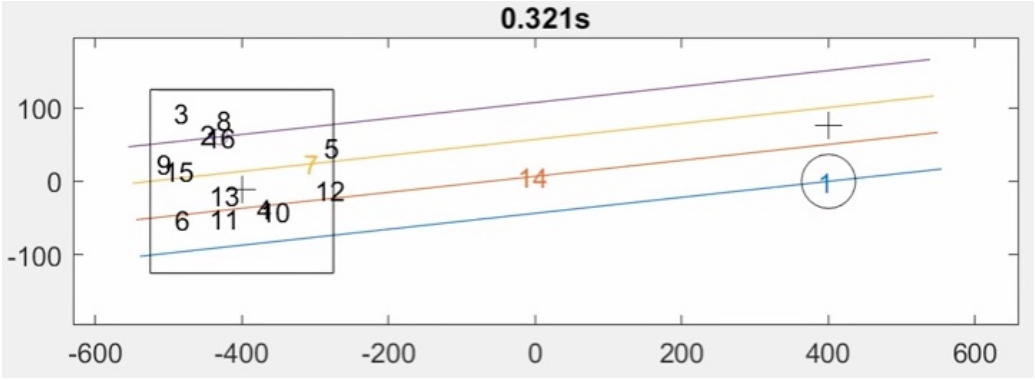
Introduction

Isochronic AG develops a novel type of pick-and-place robot. The difference between state-of-the-art robots and the Isochronic robot is the simultaneous transport of multiple parts rather than a sequential transport. The first video shows a comparison between a delta robot (left) and an Isochronic robot (right) for the application of picking cookies from a moving conveyor. It is evident that the 4 parallel rails allow for a much faster throughput while being more compact.



Video link: https://www.dropbox.com/s/s5d5w6fgi84kwt6/Isochronic_Dynamic_Delta_CMR_Comparison.mp4?dl=0

The second video shows an Isochronic robot transporting 16 randomly distributed products from a static pick zone to a place zone.



Video link: https://www.dropbox.com/s/1pp13rqmivjh9rs/Isochronic_Static_centerDistance_800.mp4?dl=0

Problem description

The fact that the 4 rails are mounted on a common gantry creates an interdependence between them, which is at the same time a critical advantage as well as a key technical challenge. Specifically, the control strategy has a great impact on the total time of transport. For example, a bad strategy would be to pick the products at the top of the pick zone with the bottom rail and vice versa, because this would require unnecessary up-down movements of the carrier arm which represents the vast majority of the robot's moving mass. But what is the best strategy, i.e. which rail picks which product and in what order?

The goal of this project is to find optimal strategies for different application scenarios. An application is defined by

1. pick zone, e.g. moving conveyor, static tray, regular or random distribution of products
2. products: one product class or multiple product classes
3. place zone, e.g. moving conveyor, static tray, composition requirements in case of multiple products

Goal

The goal of this project is to use reinforcement learning to find the best sequence of pick and place movements in order to reduce the total time. To this end, Isochronic will provide a model of the robot's kinematic and a set of customer applications. The academic partner will develop the learning framework to find the best sequence for each application. Furthermore, the framework should be generic enough that future customer applications that have not been provided initially can be easily added.