

Autumn Award 2017



In the framework of the sixth results- and cross-linking workshop, hosted by BMVIT and FFG, the project 'EntKuRo: Automated handling of a screw coupling of freight wagons' was honored with the **Autumn Award 2017**.

Timeline

- **Since 1980** Several concepts have been researched dealing with the automatic separation of freight wagons. But no practical use is known.
- **In 2015** Feasibility study carried out by the project partners, regarding automatic opening of the screw coupling.
- **In 2016** First laboratory experiments with the uncoupling robot and the automatic loosen of the coupling.
- **Nov. 2017** Completion of sensor concept.
- **Early 2018** Start of field tests with the uncoupling robot.
- **Juli 2018** Initial operation of the uncoupling robot on the rail track.
- **End of 2018** Planned beginning of field trials with the automatic loosen of the coupling.



Project partners & their main tasks

University of Applied Sciences Upper Austria: Project management and technologic realization

ÖBB Infrastructure AG: Definition of requirements and operating experience

University of Applied Sciences St. Pölten: Operational analysis, infrastructural requirements, test planning and realization

AIT Austrian Institute of Technology GmbH: Operational involvement, workers' protection, economic evaluation, contribution and support in finding technical solutions

ULBRICH Maschinenbau Betriebsg.m.b.H: Manufacturing and commercialisation

Contact

FH-Prof. Dr. Burkhard Stadlmann
Christoph Zellner, MSc.

University of Applied Sciences Upper Austria
Stelzhammerstraße 23, 4600 Wels/Austria

Phone: +43 5 0804 43420
Fax: +43 5 0804 943420
E-Mail: burkhard.stadlmann@fh-wels.at
christoph.zellner@fh-wels.at

Cooperation partners & Funding agencies



Mobilität der Zukunft

Uncoupling Robot for the automatic marshalling yard

Project: Automated handling of a screw coupling of freight wagons



Introduction

Based on the fact that the screw coupling is still used in Europe for the majority of freight wagons, the operations at marshalling yards are not state of the art. All operations must be done manually by workers called shunters and this is a tough and dangerous task, especially the loosening of the coupling and the uncoupling process.

Therefore a mechanical device shall be developed to do these tasks automatically to increase productivity and safety. To achieve this, the complete process was analyzed and potential solutions were developed and tested. Also Lifecycle Management and the protection of workers had to be considered during the development process.

Additionally, a sensor system is necessary to provide the required data for the control of the mechanical parts. However, an existing working solution was not available and therefore had to be developed and integrated. This complete solution has been tested in a laboratory model and furthermore the uncoupling will continue to be tested at the marshalling yard in Linz on moving rail wagons.

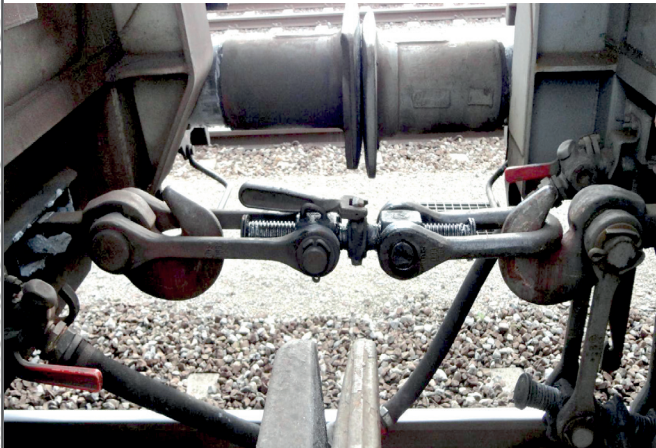


Fig. 1: screw coupling

Uncoupling

(Status: in production)

To uncouple the screw coupling the coupling has to be lifted out of the hook. This can be done on moving or standing trains.

The following solution deals with moving trains. Based on the toggle lever principle it is possible, with two cable drives, to accelerate the mechanism to train speed. Once the top edge of the rail is in position, the coupling can be released from the hook. The uncoupling is only possible if the characteristic shape of the contact plate is used.



Fig. 2: shunter lifting the coupling

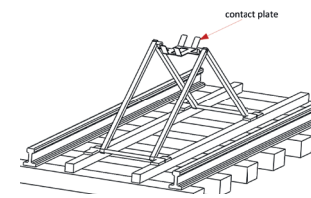


Fig. 3: principle solution to uncouple off the hook

Loose the coupling

(Status: coming up soon)

This part of the separation process happens while the train is standing at the reception sidings. An opened gear ring makes it possible to put the mechanism over the coupling. The gear ring is subsequently moved in a rotary motion, takes the coupling-screw lever with a wedge manipulator and thus the coupling is loosened.



Fig. 4: shunter loosening the coupling

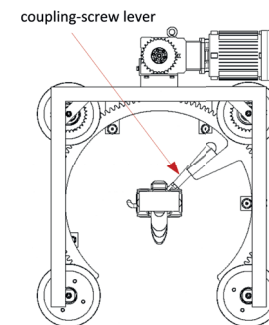
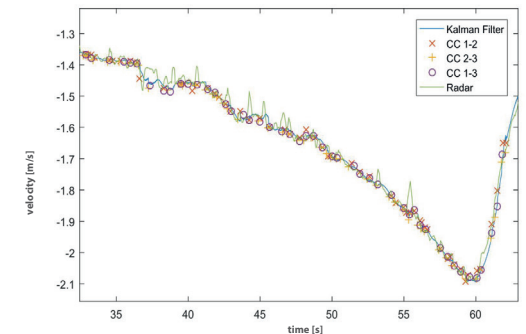


Fig. 5: mechanic principle to loose the coupling

Sensor System

A powerful and robust sensor and software system is essential to guarantee that the uncoupling will be done successfully. Beside other tasks this system detects the couplings on the train, it checks the state of the screw coupling and estimates their position. Furthermore it delivers information about the speed of the train in high accuracy.

All of the sensor signals have to be translated to form one complete representation of the coupling position and its velocity. A kalman filter is integrated in order to consolidate the different readings.



Life Cycle Management and workers' protection

The concept of PLM (Product Life Management) can also be applied to an uncoupling robot, which is why a framework has already been developed in this research phase. It will elaborate which aspects must be taken into account in the course of product lifecycle management in order to produce a sustainable uncoupling robot afterwards.

Railway operation is very strictly regulated by operating regulations and technical prescriptions due to the possible system-induced hazards. These specifications are summarized in precisely developed operating instructions. In order to take account of all relevant regulations concerning occupational safety of employees and safety of operational processes, these were transferred to the defined location for the test set-up in the marshalling yard Linz and were respected during the technical design and execution of the uncoupling robot (scheduling and provision of working spaces and clearance gauges or outlines, safe distances, etc.).