NEWSLETTER

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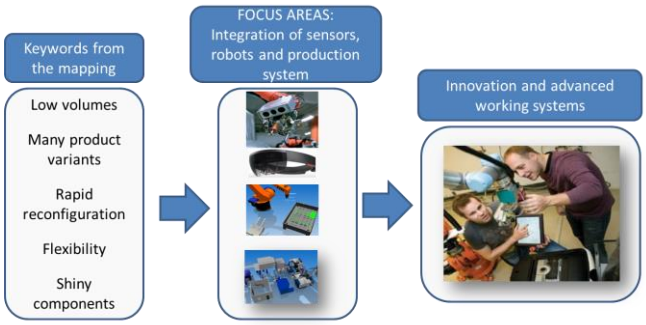
About Research Area 2 (RA2)

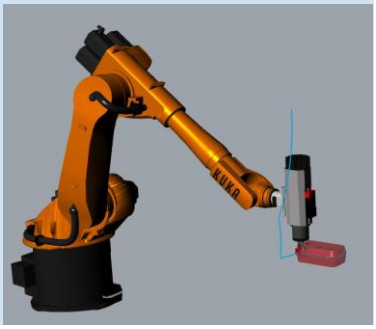
The research area Flexible and Robust Automation concerns the novel technologies and methodologies within automation to support innovation processes and advanced work systems in the manufacturing industries.

Novel automations technologies and methodologies, and smart integration of those, open new ways to use automation and robotics in manufacturing systems. However, several research challenges still need to be addressed to release the potential for innovation. Within this research area we focus on generic challenges identified from a mapping at the industrial partners conducted in the timeframe 2018-23.

Some examples are bin-picking, safe and efficient motion planning in dynamic environments, "batch size one" robotic assembly, robotic flexibility in additive manufacturing, and effective and safe development of robotic assembly processes. Several of these challenges also link to the other research areas within the SFI.



PhD news

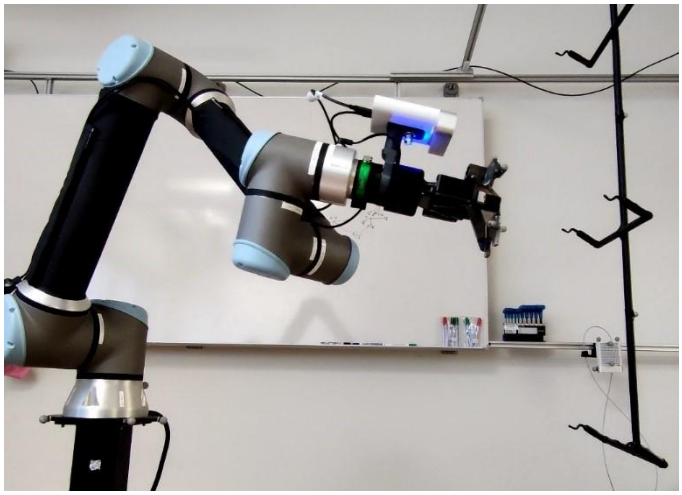


– Robots in deburring processes – RA2

Ingrid is working on automatic deburring of cast parts with robots.

The first step in this process is to get a 3D representation of the actual workpiece to be deburred. She collaborated with SINTEF Digital on their work with 3D scan and CAD model registration and burr detection. The output from this work will be further processed to create a 3D mesh.

This mesh will be used in an automatic tool path planning system for robotic deburring that has been developed. An initial test of the system has been performed on an industrial manipulator.



Update on the research activities in RA 2

Work-in-progress: Loading and unloading of hanging trolleys

Loading and unloading of overhanging trolleys are common tasks for instance at spray painting facilities.

They are often manual and can therefore constitute a large cost to the manufacturing industry in Norway. Furthermore, the tasks are tedious and can pose significant health-related issues.

We have worked towards an automated solution which roughly consist of 1) object pose prediction and velocity estimation, 2) real-time trajectory generation for the robot manipulator arm, and 3) robot trajectory tracking and gripper commands execution.

The current solution uses a marker-based real-time motion capture system to measure the position and orientation of the objects, but we are working towards replacing this with a CAD-based object-tracking method. In addition, we are working on fundamental methods to better predict the motion of the hanger and objects.

PhD news

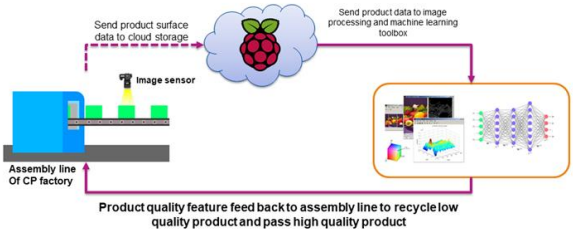
Tamal Ghosh – inline inspection module for CP factory – RA2

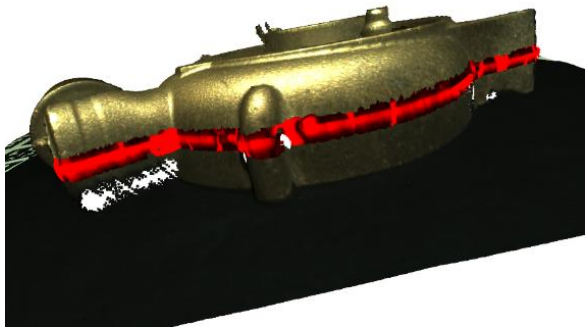
Tamal is working on product quality inspection inside the Cyber-Physical (CP) factory in MANULAB at NTNU Gjøvik.

His work is focused on the development of contact-less approach and perform a comparison with the traditional stylus-based contact method for surface roughness check. The product surface images are captured using HD image sensor and analysis of the images is done using image processing algorithm which can extract a number image features.

Further, the extracted features are being correlated using machine learning with the surface roughness reading from stylus-based instrument.

The said correlation can further identify the nature of the image features which can derive feature-based objective functions in terms of machining parameters for process optimization. The major challenge in this work is to standardized the image features of product surface as response parameters for machining process optimization



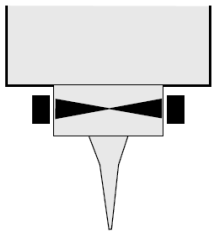


Work-in-progress: 3D vision-based CAD registration and burr detection

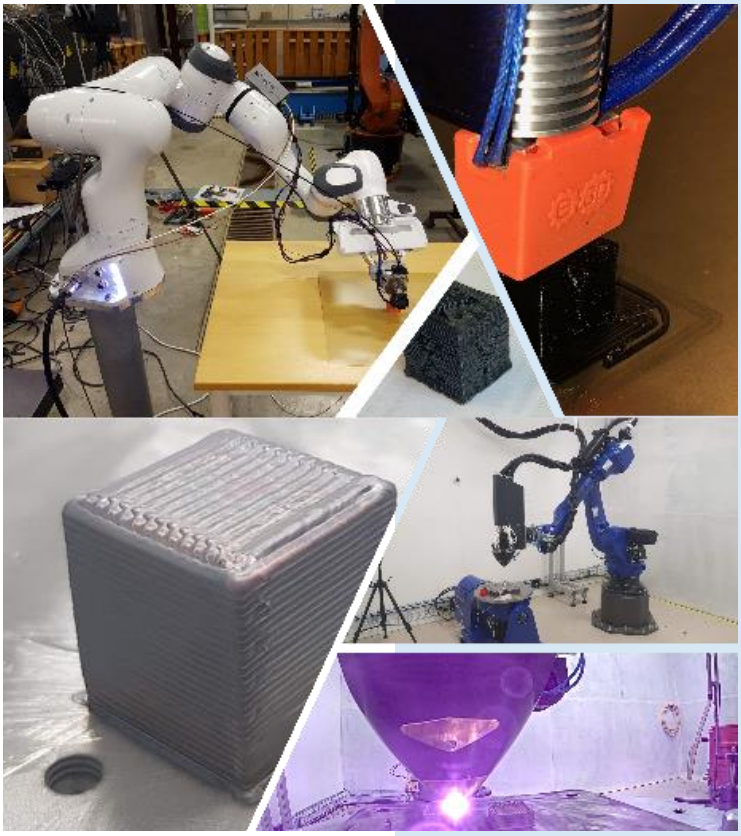
To enable automatic deburring of manufactured parts with robots, there is a need for new methods for burr detection and registration of a 3D scan with a CAD model. Learning-based methods show great potential for quality control and anomaly detection, but more work is needed to develop general and robust methods for 3D feature extraction that does not require enormous amounts of labelled data. We propose a new method that learn features for 3D data processing in a self-supervised manner. These features are successfully used to estimate burr height on a cast brass part from Mjøs Metallvarefabrikk.

Work-in-progress: Hapro, glue dispensing: SFI case

The main problem is the formation of bubbles embedded in the sealant. Some gas inclusions (bubbles) are large enough that they leave stretches depleted of sealant in the laid string in the joint.



In today's manufacturing process the string is inspected and re-worked manually by a dedicated operator. The origin of the bubbles is not known. A great amount of blog posts by engineers makes it clear that bubbles in sealants and adhesives is a widespread issue.



Work-in-progress: Plastic 3D print
(Robotized Additive Manufacturing)

The research on additive manufacturing with robot manipulators is continued by Alexander Waller Johnsgaard, a master student working on fused filament deposition using the Franka Emika cobot.

With the new hybrid manufacturing lab at Valgrinda, we will also explore direct energy deposition and feedback control with summer students that will continue with a master thesis on the topic.

Work-in-progress: Kongsberg Maritime, mobile assembly – SFI case

Handling and towing winches for vessels are typically manufactured in only a few variants but several hundred units per project. The logistics involved are considerable for each project, with components being sent around the world to undergo various assembly operations and processing.

Together with Kongsberg Maritime, we are conducting an introductory study on the feasibility of modular and robotic production lines for winch assembly that can be transferred and put into operation for production and automated assembly at yards worldwide.

The production lines are packed down and sent to the next yard when a project is completed. Such a manufacturing concept requires robotic production lines that easily can be configured and set up quickly, with just as easy and quick disassembly.

The motivation is to reduce the considerable amount of logistics, reduce the lead times, the cost of tied-up capital, and reduce the impact on the environment.

KONGSBERG

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