Technology/Process: **Robotic drilling with force feedback control**

Responsible: **Saab**

Partners: **ÅF Industry, Linköping University**

Work package: **4.2 – ”Automated assembly”**

GRÖN FLYGTEKNISK DEMONSTRATION

Description of Technology/Process:

By using a force sensor integrated in a robot control which sense critical process forces during positioning, the robot can maintain the position within tolerance independently of where the tool is positioned within the robot work envelope.

Before:

The application of robotic force feedback drilling has been tested before the project in a laboratory environment. Therefore the maturity for the application was at the time for the start of the project low (TRL3).

Illustration:

Robotic drilling without force sensing at Saab Aerostructure

Keywords:

Robotic,
drilling,
assembly,
automation,
force sensor

Benefits:

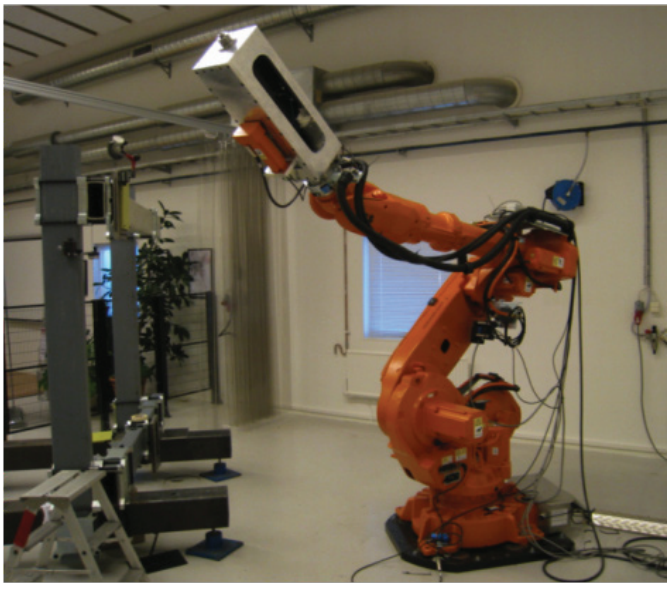
- The use of a standard force sensor simplifies the robotic process tool (end-effector) since moving parts can be eliminated and mechanisms can be simplified. The solution makes it possible to apply drilling in the whole work envelope of the robot which eliminates the need of extra NC-axis such as tracks. The solution can substantially reduce the cost for the robotic drilling application.

Work performed:

An existing robot ABB 6640 together with a standard 6-axis force sensor ATI Omega 160 IP65 has been used. An end-effector has been developed using a standard spindle mounted on a guide with a ball screw and a motor for controlling the feed. The end-effector is equipped with a pressure foot fixed in the end-effector housing. The force sensing and its integration with the robot controller has been tested and the parameter settings has been trimmed in order to optimize the drilling process.

The positioning of the drilling end-effector without using the force feedback gives a slippage of its position of up to 1,3 mm in a position approximately 2 meters off center from the robot base (outer range of the robot work envelope). Using the force sensor reduces this miss-positioning to less than 0,4 mm.

The conclusion is that the force sensing reduces slippage (miss-positioning) of the drilling end-effector substantially which eliminates a lot of extra features in the robot application to handle this phenomena. A TRL5 level of maturity is estimated in the final results.



Future developments & exploitation:

The results gives confidence to future industrialization of robotic drilling applications using force sensor feedback supplied by Swedish suppliers of robotic solutions.