

Automation of paint removal (project FIXAR)

Automation of paint removal, innovating an industrial robot, internship/graduation AE 3rd/4th year

Ruben van den Brink, June 2020

Summary

A Dutch consortium initiated by Inholland Composites recently started a 2-year research program to develop knowledge and technology for sustainable composites repair. For the upcoming internship- and graduation period starting september 2020, Inholland Composites Delft is looking for an aeronautical engineering student to perform research in the field of automated repairs. When a composite repair needs to be executed on an aircraft part it is important to remove the paint from the part. This is currently a labor intensive job and requires to be automated.

Background

How can the aviation- and wind energy sector make composites repair economically viable by applying automated technologies? To answer this question, Inholland Composites, part of Inholland University of Applied Sciences, initiated a consortium with Dutch aviation- and wind energy SMEs, CompositesNL, and the Saxion and Amsterdam Universities of Applied Sciences. Starting in October 2019, they will embark on a 2-year applied research project FIXAR: **Future Improvements for Composites Sustainable Automated Repair**. (<http://projectfixar.nl>)



Figure 1 New applied research project FIXAR. An Inholland/Saxion/HvA collaboration with Dutch aviation- and wind energy SMEs, and CompositesNL (ref: Inholland Composites)

Driven by a SiA Raak MKB grant, the research question is co-developed with Dutch windenergy- and aerospace companies SPECTO Aerospace, Fusion Engineering, KVE Composites, Colosso Engineering, Pontis Engineering, Schatmaker and Carbon Racing. These SMEs have signed up for project FIXAR as their interest has a close link to their businesses. To ensure knowledge dissemination within the Dutch Wind- and Aviation industry an advisory board has been established consisting of the Royal Netherlands Air Force, the KLM, Fokker GKN, the NLR, the TU Delft, Field lab Zephyros, the Hanze University of Applied Sciences and LM Windpower.

Outline FIXAR research program

Both windenergy- and aerospace industry rely on lightweight structures using fiber reinforced polymers and have a significantly growing installed base around the world. Both industries share similar needs, but differ in maintenance requirements, processes and maturity stages. By combining forces, this consortium is looking for ways to share and simplify knowledge on composites repair to aim for innovations using automated solutions to break through the current state of the art, often locked in the certified procedures owned by the OEM's.

Four work packages will support answering the main research question and provide focus for the envisioned improvements for composites sustainable repairs:

- workpackage 1: benefits in automated repair solutions for (offshore) windfarms
- workpackage 2: repairability using thermoplastics
- **workpackage 3: sustainable composites repair for aerospace**
- workpackage 4: Mixed Reality for inspection and validation of repaired composites



Figure. 2. FIXAR, applying new ways of automation for repairing composites for the windenergy and aviation industry (ref: Inholland Composites).

Internship/graduation assignment description

For work package 3 of project FIXAR, Inholland Composites Delft is looking for an aeronautical engineering student to perform research in the field of automated paint removal. Currently, paint is removed manually which is labour intensive job. To reduce labour cost automation is necessary. The development of this system is already started at Inholland Composites. The system currently in development will be designed for removing paint on flat surfaces. The system contains multiple sensors to monitor and guide the paint removal. The goal of this assignment is to continue the development of the system towards curved 3D structures. The desired structure for paint removal is a radome.

Knowledge base

Inholland Composites performed several RAAK-MKB research projects (since 2014) including *Robocompo* (<http://robocompo.nl>) and *First-Time-Right* (<http://r1ght.nl>), together many SMEs with the aim to automate the vacuum infusion process and achieve first-time-right production. These projects provided a significant expansion in the knowledge base for Inholland where applying automation technologies have proven to be an attractive value proposition in composites engineering, production and validation. Several simulation- and training proof-of-concepts have been developed using VR and AR resulting in successful demonstrators, which are currently available in the laboratory of Inholland Composites.

Activities

This internship is a chance to improve your expertise in composite materials and its maintenance methods. You will get familiar with programming of robotic and sensor systems. Programming will largely be done in LabVIEW. Empirical testing will involve the testing of the robot operation and quality assessment of the robot operation.

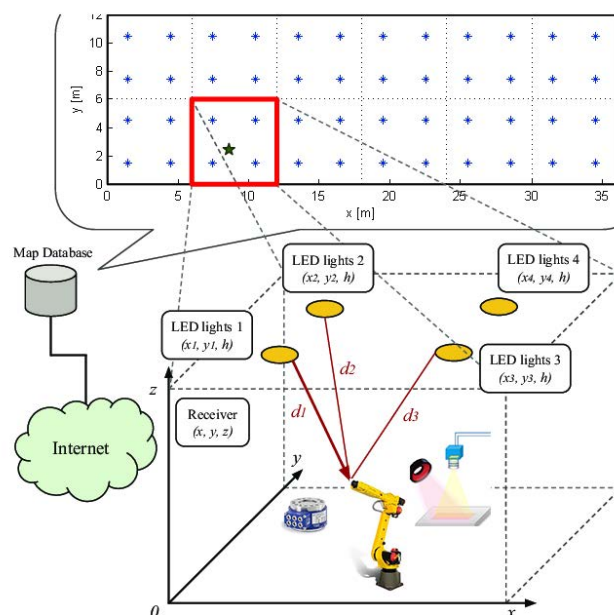


Figure 3 schematic overview sensoric system for automated paintremoval

Scope of work

During all research activities within project FIXAR it is intended for the student to gain practical experience with composites. So, even if you're working on a 'theoretical' business-case, you will have to get your hands dirty in the lab. Thus, during design you will learn about manufacturing, maintenance and materials. We are striving to create physical demonstrators in the design projects. Furthermore, a typical scope of work consists of these elements:

- Project plan, research questions, research method
- Literature study, research on sensing- and robot technologies.
- Concept and detailed design
- Demonstrator
- Analysis of test results
- Communication and interaction with stakeholders, companies and experts.
- Communication through <http://projectfixar.nl> (status updates to consortium, video's)
- Technical report

Company information

Inholland Composites, located at Inholland in Delft and Alkmaar, is a very well equipped, high-tech laboratory in the field of composite materials and structures. The focus is on fibre reinforced plastics which provide durable and lightweight solutions in a wide range of applications. Inholland Composites needs students from various technical departments and it's our mission to put theory into practice and provide students with up-to-date education, which connects to today's business. Visit <http://inhollandcomposites.nl> for more information.

Intership period: September / Februari 2020

Assignment Written by: Ruben van den Brink

Checked by: Arnold Koetje

Authorised by: Antoine Gerritse