Project description (First-time-right)

Smart mould using sensors in mould/vacuum bag, Internship / graduation

Arnold Koetje, May 2018

Background

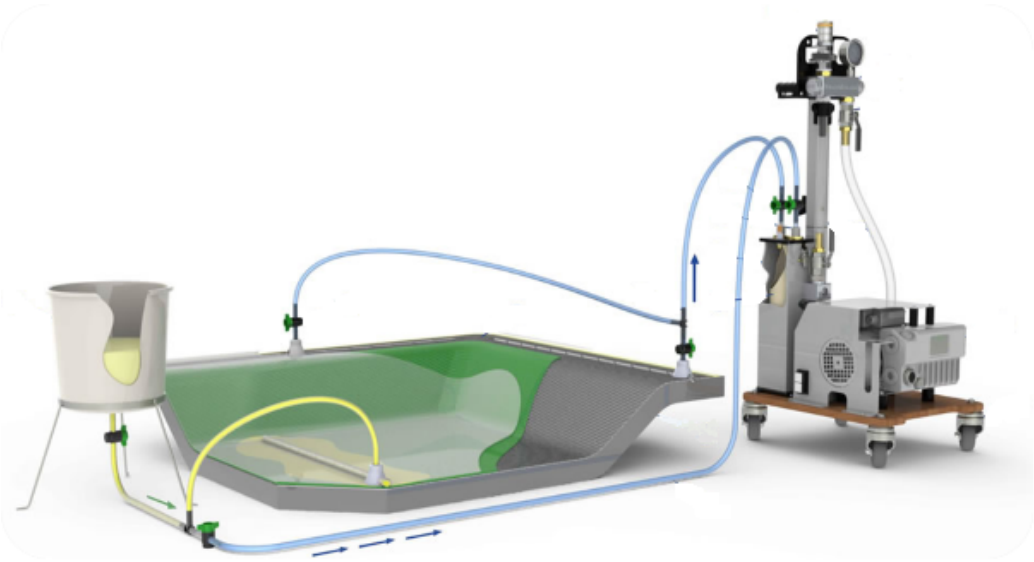
Manufacturing of composites can involve a lot of manual labour, which makes it more expensive and less consistent. In order to decrease the manual labour automation production technologies for composites require further development. Inholland Composites started a RAAK-MKB research project in September 2014 , *Robocompo,* together with 10 SMEs with the aim to automate the vacuum infusion process. The project was a great success and the result can be seen in the Composite Labs in the form of a robot with several end-effectors.

One of the conclusions of the project was that almost the whole process can be automated, but the biggest challenge is controlling the infusion process itself. This subject resulted in a new RAAK-MKB project named: *First-time-right injections for the production of one-off or small series of composite products. More information is available on* http://r1ght.nl

Project description

For this research project the focus will be on improving the quality of the infusion in such a way that complex and one-off products can be infused in one try, instead of many. To achieve this, smarter-moulds (with sensors and heating) are necessary which can measure- and control the resin flow. It is expected that vision systems can play a crucial role in the monitoring of the process.

The goal of this graduation project is to develop a mould or vacuum bag that includes sensors to monitor the vacuum infusion process in combination with vision systems. The data will be used to develop a real-time control system that automatically controls the vacuum infusion process.



Activities

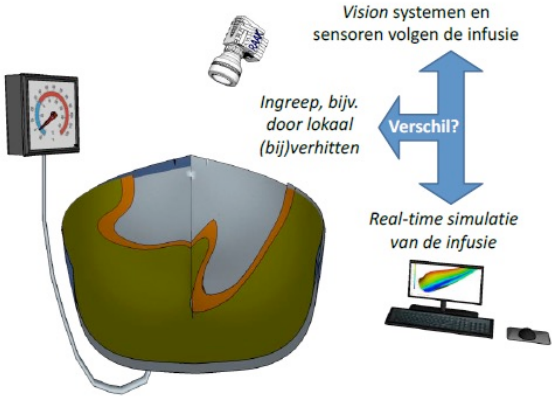
This internship is a chance to improve your expertise in composite materials and out-of-autoclave production methods. You will get familiar with technologies used in the Smart-Industry and have an opportunity to enhance your systems-engineering skills. The following activities are expected:

- Research into existing production methods and identifying challenges encountered by composites manufacturers during the vacuum infusion process.
- Conducting research into various sensors and vision systems, and how to apply them for monitoring the vacuum infusion process.
- Integration of sensors into a mould or a vacuum bag that is reusable.
- Designing a control system to adjust the vacuum infusion process using LabVIEW, with real-time input from the sensors and vision system.

Scope of work

During all projects at the First-Time-Right-projects 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 methods 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 t, common problems etc.
- Functional analysis and concept study
- Concept design / Detailed design
- Demonstrator for verification and validation
- Testing of the control system
- Analysis of test results
- Communication and interaction with stakeholders, companies and experts
- Communication through http://r1ght.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.

Graduation period: September 2018 / January 2019

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