Univ.-Prof.
Prof. h.c. (Moscow State Univ.)
Dr.-Ing. Dipl.-Wirt. Ing.
Thomas Gries
Institutsleiter

Erik Bell
WM

Mein Zeichen: EB
31.03.2020

Project Titel:	Development of a system for the generation of adjustment suggestions for cross winding machines on basis of a simulation
Partner:	Fraunhofer ITWM, Kaiserslautern
	GFaI, Berlin
Duration:	01.06.2017 – 31.03.2020
Funding Agencies:	AiF _ IGF-Nummer 19552 N

Mission Statement

There are 200 finishing companies in the textile and clothing industry in Germany. 90 of the 200 finishing companies are operating dyeing plants. Almost all of the dyeing plants are classified as SMEs.

A total of approx. 361,000 tonnes of fibres were processed in the clothing and home textiles sector in Germany in 2012. It can be assumed that approx. 30 % of these fibres are bobbin-dyed in Germany. This results in a total of 110,000 tonnes of bobbin-dyed yarn per year. When dyeing the bobbins, the uniformity of the through-dyeing of the yarn package is of particular importance. According to industry figures, the reject rate for poorly dyed bobbins is 2 % and thus around 2,200 tonnes per year in Germany. The dyer suffers sales losses due to complaints and rejects amounting to approx. 4 €/kg yarn. Every year, German finishers incur costs of approx. 8.8 million € due to dyeing errors. According to internal calculations of a spinning mill with bobbin dyeing attached and an annual capacity of 4,500 t of dyed yarn, rejects amounting to around 400,000 € per year arise due to bobbin defects.

The aim of the interdisciplinary DensiSpul project is to generate setting proposals for standard and future winding machines in order to reduce the reject rate of poorly dyed bobbins by at least 15 % and to shorten set-up times. A reduction of 15 % of the winding errors means an annual saving of approx. 1.3 million € in Germany.

Solution

The solution is based on the approach of automatically generating setting parameters specifically for different winding machines in such a way that the density distribution in the bobbin becomes homogeneous. A homogeneous

density distribution in the bobbin is the decisive factor for uniform through-colouring of the bobbin. The setting suggestions are generated by an optimization algorithm based on simulations of the density distribution in the winding body. The development of the material models and the validation of the virtual density distributions is carried out via microcomputer tomography (µCT). The achievement of the objectives is ensured trough cooperation of different competences from the fields of textile technology, 3D data processing and simulation.

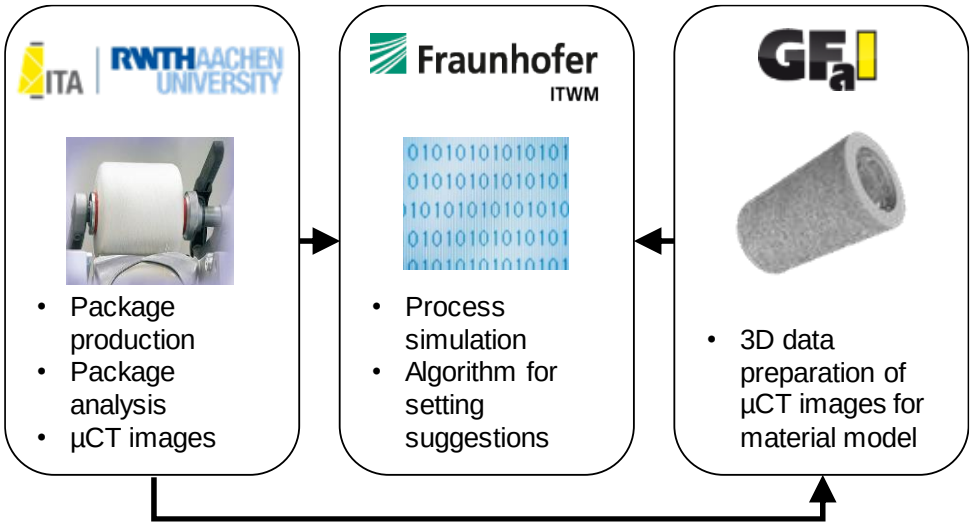

Figure 1: Interdisciplinary approach of the project DensiSpul

Project Results

Within the scope of the project, a simulation-based adjustment recommendation for cross winding machines was developed. The aim of the project was to reduce the number of dyeing faults and to decrease the set-up times. Based on the measured data of the packages a virtual package was modelled. For this purpose, a physical model was developed to describe the thread distribution. The package model was then backed up with a density model and transferred to a porous body. Then the dyeing process was simulated and the flow was evaluated by means of an objective function. By using an optimization algorithm, the crossing ratio was adjusted during the winding process. Based on this algorithm new winding programs were developed. By using the setting suggestions for the automatic cross-wound package, the color deviation for the coarse yarns (Nm 34) could be significantly improved. The color deviation dE was reduced by approx. 36 % for packages produced by wild winding and by approx. 51 % for packages produced by

step precision winding. For the finer yarns (Nm 85) the use of the simulation-based settings had no influence on the color deviation. A PC program was programmed which provides a decision support in the process of production control to optimize the winding kinematics and the resulting density distribution in the package.

Acknowledgement

The IGF project AiF no. 19552 N of the Forschungsvereinigung Forschungskuratorium Textil e.V., Reinhardtstraße 12-14, 10117 Berlin was funded by the AiF within the framework of the programme for the promotion of joint industrial research and development (IGF) of the Federal Ministry of Economics and Technology on the basis of a resolution of the German Bundestag.

Kontakt

Institut für Textiltechnik
der RWTH Aachen University
Otto-Blumenthal-Str. 1, 52074 Aachen

Erik Gordon Bell, M. Sc.
E-Mail: erikgordon.bell@ita.rwth-aachen.de
Tel.: (+49) 241 - 80 23446

Gefördert durch:

Bundesministerium
für Wirtschaft
und Energie

aufgrund eines Beschlusses
des Deutschen Bundestages