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

John Lammers
Research Assistant

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Project title: Automatic Needle Change on Large Circular Knitting machines

Partner: RSG Automation Technics GmbH & Co. KG

Duration: 12/2017 –12/2019

Funding Agency: „Zentrales Innovationsprogramm Mittelstand – ZIM“

Deficit in state of the art

- 2 needle changes per day (total of 30 minutes standstill per machine / day)
- Annually € 15000 scrap / machine (for standard items, such as T-shirt fabric)
  - 3-10 times higher for technical yarns (silk, polyamide, glass, aramid)
- Previously changed manually by experienced staff
  - Demographic change causes shortage of skilled workers

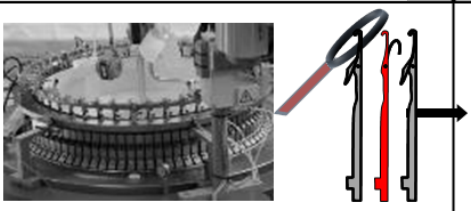
Objective (technical and economic benefit)

- Needle change within five minutes
- reduction of rejects due to standstill of the knitting machine by 2/3 (66%)
- Reduction of reject costs by 10000 € / machine (standard product)
- > € 2,000,000 increase in sales of German large circular knitting (SMEs)
- more efficient staffing

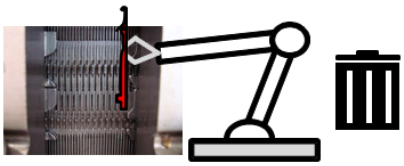
Approach

Intelligent needle exchange system

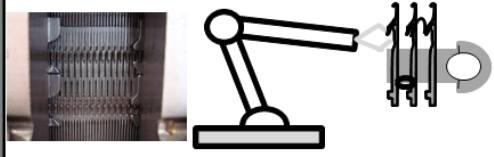
1. Detect broken needle



2. Dispose of the broken needle



3. Select new needle from magazine



4. Position and insert the needle

Technical risk

- Precision of the manipulator and gripping technique (complex movement, small tolerances)
- Maintenance of knitting quality / damage to the goods
- Modular structure of the system

Economic risk

- Market-oriented development with regard to system costs
- Acceptance by Workers
- Reliability in everyday use
- Reduction of downtime by 66%

Mission statement

Large circular knitting machines are used in the textile and clothing industry for mass production of textile fabrics (for example mattress coverings, T-shirts, etc.). The knitting needles are exposed to heavy mechanical stress during the production process. As a result, needles break (at least twice a

day / machine). This results in an annual loss of goods amounting to approx. 15,000 € / a per machine. The aim of the research project is to reduce downtimes and scrap costs by 50% by means of an automatic needle changing system.

Approach

The developed needle changing system consists of mechanical components (e.g., rapier head and manipulator mechanics) as well as electronic components (e.g., the machine control). For the development of the gripper head, gripper techniques available on the market are used and adapted. The mechanism for positioning and moving the gripper is developed with the help of standard components. For the fine positioning of the gripper head for the needle delivery, a mechanical concept is developed. The machine control is realized by means of microcontroller systems available on the market.

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Contact

John Lammers, M.Sc.
Fabric Production
Institut für Textiltechnik der RWTH Aachen University
Otto-Blumenthal-Str. 1
52074 Aachen
E-Mail: john.lammers@ita.rwth-aachen.de
Tel.: +49 241 80 22 083