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Development of an active low-cost thread tensioning system for a crochet machine

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Introduction & Aim

- As part of an earlier project, a crochet machine “CroMat” was designed, built, and a patent was filed for it [1,2].
- An essential part of this crochet machine is an active thread tensioning device, which is needed to regulate the thread tension on the machine’s crochet needle.
- Until now, a special supplier with an integrated thread return system has been used for this purpose (Fig. 1).

→ The current project focuses on developing a thread tensioner tailored specifically to the crochet machine (Fig. 3-5).

Construction

Overview of CroMat crochet machine

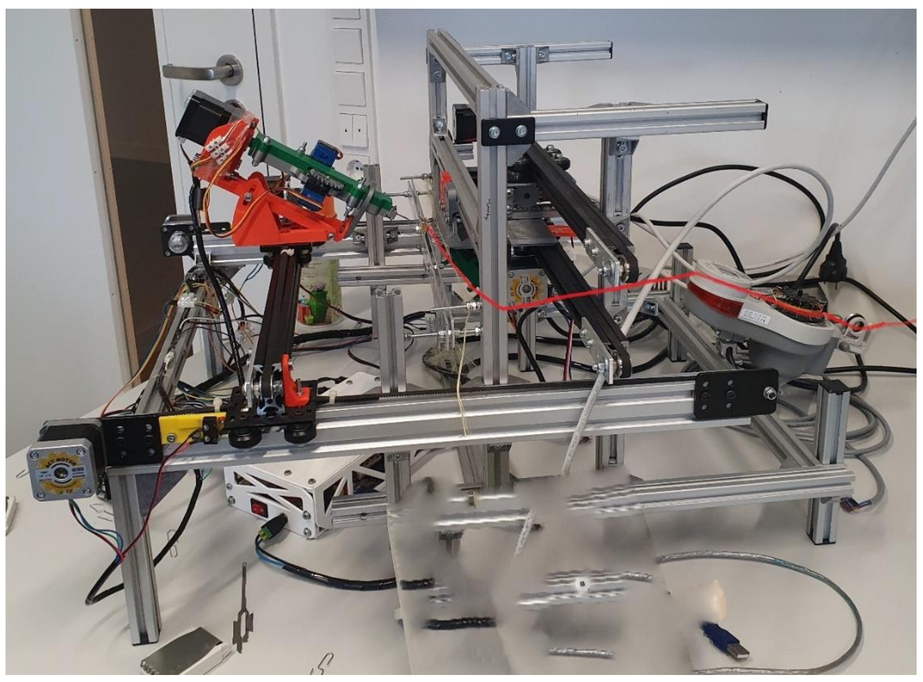

Fig. 1. CroMat crochet machine with commercially available active yarn feeder EFS 920 (MEMMINGER-IRO GmbH).

Requirements for new active yarn feeder

- Keeping the thread tension constant (range of 3-13 cN)
- Typical yarn count ~ 750 dtex
- Yarn consumption ~ 16-25 mm/stitch
- Yarn take-up path ~ 5-19 mm/stitch

Construction

- Based on (20 mm x 20 mm) aluminum profile
- Wrap-around brake for generating pre-tension
- Return spring for storing the thread
- Thread wheel for moving the thread
- Thread tension gauge
- Control

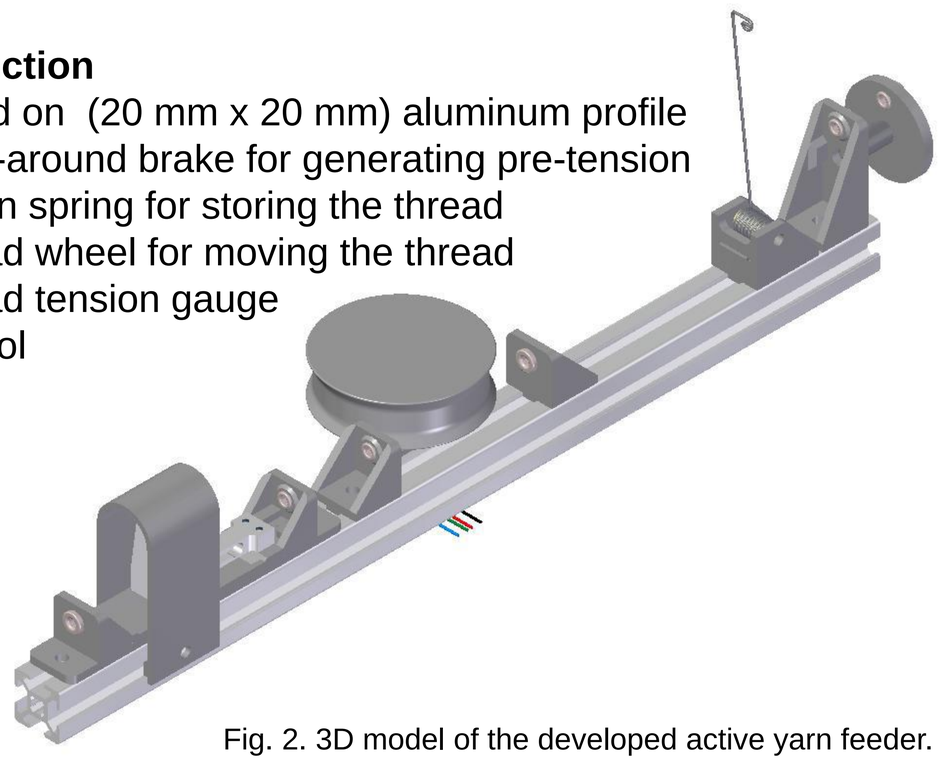

Fig. 2. 3D model of the developed active yarn feeder.

Results

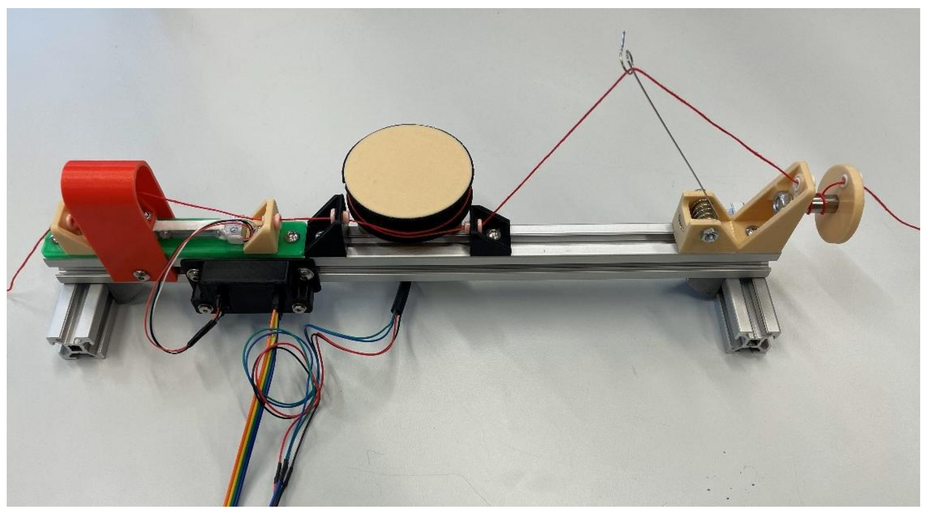

Fig. 3. Self-built active yarn-feeder.

Testing the thread storage showed its proper function:

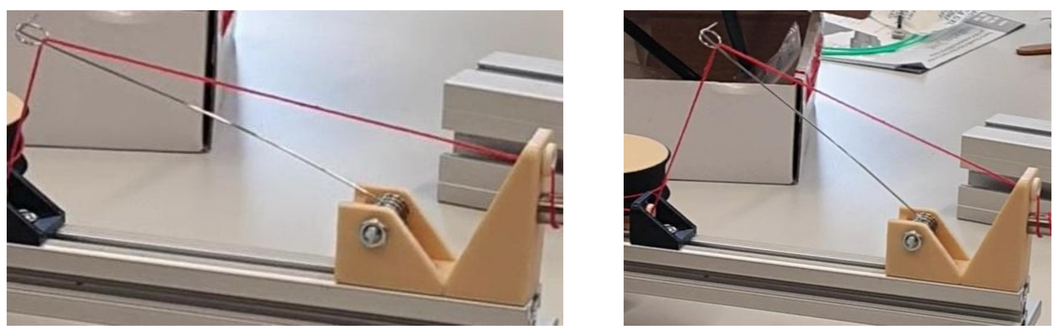

Fig. 4. Thread storage empty (left panel) / filled (right panel).

Self-constructed thread tension sensor:

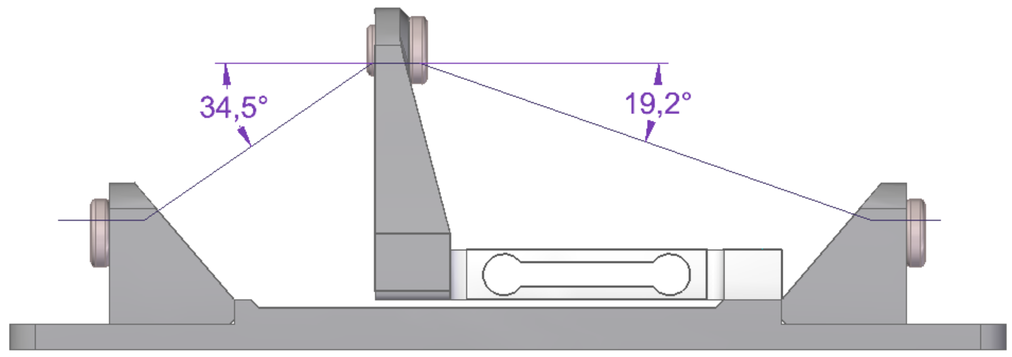

Fig. 5. Setup of the implemented thread tension sensor.

- Measurement with a load cell by HT Sensor Technology Co., Ltd., based on a 4 strain gauges connected as full bridge
- Maximum force at load cell is 26 cN → sufficient for maximum thread tension of 13 cN

Literature

[1] J. L. Storck, L. Steenbock, M. Dotter, H. Funke, A. Ehrmann, Principle capabilities of crocheted fabrics for composite materials, *Journal of Engineered Fibers and Fabrics* 18, 15589250231203381 (2023)

[2] J. L. Storck, B. A. Feldmann, Y. Kyosev, Design tool for automated crocheting of fabrics, *Communications in Development and Assembling of Textile Products*, 4(2), 254–272 (2023)

Conclusion and outlook

- A yarn feeder system for a crochet machine must be able to dynamically adjust and regulate thread tension during stitch formation, taking into account different yarn lengths per stitch.
- The newly system can in principle fulfill these requirements.
- Communication between tension sensor and machine will be improved to further optimize the yarn feeder system.