

Applications of Micromachines in Fabric Formation

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Micro electro-mechanical systems (MEMS) technology has gone from an interesting academic exercise to an integral part of many common products in several industries such as in the medical, automotive and ink jet industries. We have identified applications for MEMS technology in textiles; but as with the most new technologies, practical implementation has been slow.

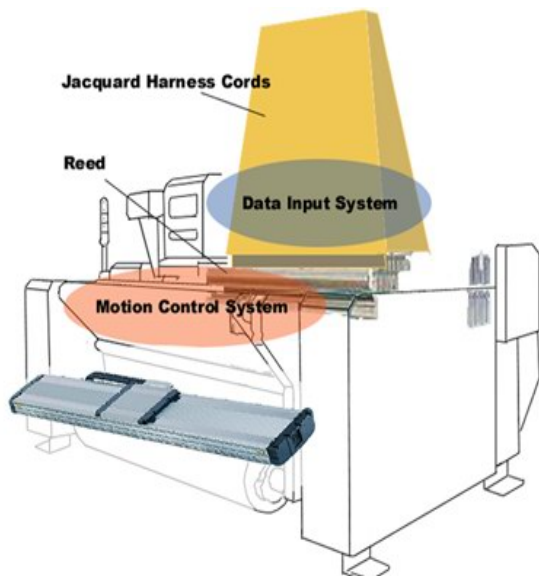
We elected to demonstrate the capability of combining MEMS with small-scale robotic devices to automate one of the few tasks that still need the weaving machine operator's intervention; repair of broken warp yarns. To achieve our goal, a knowledge regarding warp break distribution is needed since the location of the warp break along the weaving machine dictates the design of devices and the steps needed to automate the repair of the broken ends. Additionally, two devices (modules) have been designed and are being built. These are termed as the broken warp ends finder and the reed dent finder modules.

Warp Break Distribution

Since the design of the automated system depends on the location of warp breaks, we are conducting an in-plant study regarding warp break location and frequency in Jacquard weaving. Initial data indicates that about 50% of the breaks take place in the region between the harness tie and the cloth fell.

Broken Warp Ends Finder Module

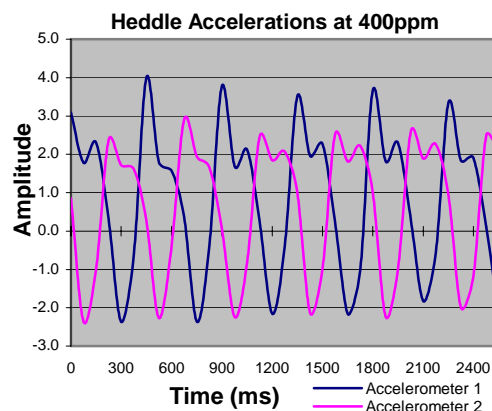
This module combines MEMS accelerometers in order to identify the location of a warp break. We decided to demonstrate the module in Jacquard weaving where each warp yarn is individually controlled by a harness cord (See Figure below). The idea is to incorporate a MEMS accelerometer on each harness cord, thus addressing every individual warp yarns. The accelerometer senses whether a



The Modules in Jacquard Weaving

We are developing mechanisms that combine micro-electro-mechanical systems (MEMS) and robotic devices to automatically repair broken warp ends, thus leading to fully automated weaving.

warp end is up or broken. We have built a test bed device with four instrumented harness cords. Filtered data generated by two MEMS accelerometers mounted on two harness cords with opposite motion is shown (See Graph below). Differences in the accelerometer signals with warp ends up and down were successfully detected (data not shown). Currently, we are mounting several MEMS accelerometers on harness cords of a Jacquard machine.



Reed Dent Finder Module

This module is designed to find a reed dent that corresponds to a broken warp yarn using a motion control system. The system employs linear stepper (or servo) motor, controller, amplifier and motion control software. We completed the module and will interface it with the broken warp ends finder.

Industry Interactions: 25 [Picanol, Staubli Corp., Precision Fabrics Group, Milliken, Riddle & Co. several US weavers to conduct in-plant study regarding the location of warp end breaks].

Project Web Address:

<http://www2.ncsu.edu/unitv/lockers/project/ntcprojects/projects/F01-S14>

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William Oxenham, a Professor and Associate Dean in the College of Textiles at NC State, joined the faculty in 1992 after lecturing at the Univ. of Leeds (England) since 1974 when he earned a Ph.D. there in textiles. Bill also earned a Bs.C. in textile physics at Leeds in 1969. His research interests center in the area of yarn manufacture and include fiber property measurement to control product and process quality during spinning.

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