USING NEW MATERIALS IN TEXTILE MACHINERY CONSTRUCTION

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Initial situation

Compared to other industrial sectors, textile machine building makes little use of carbon fibre composites, although these materials offer excellent properties which could be used in the textile machine construction sector, too.

Research target

The research project is focussed on the application of plastics, with or without fibre reinforcements, in 4 different subassemblies belonging to two textile machines, a circular loom and a knitting machine. The first 3 sub-projects (heald shafts/healds, shuttle base plate, weft carrier) were aimed at achieving similar objectives :

- reducing weight while preserving or increasing stability and strength, for increased machine performance,
- reducing costs by using new materials and altering the design of the machine.

Under sub-project 4 (yarn gripper), a soft but extremely wear resisting material was to be identified and tested.

Research result

Sub-project 1 - Heald shafts/healds
Two different designs were examined :

I. Heald support manufactured according to the Tailored Fibre Placement Technology,
II. Modular construction of the heald support consisting of one flat double-T beam provided with two screwed-on heald groups.

FEM calculations show that Version I offers good mechanical properties, but that its manufacture is too expensive. A component part consisting of short glass fibre reinforced thermoplastic, called Kurz-GF-PA-GF35, made by injection moulding, meets mechanical requirements excellently and is much more cost-effective when produced in large numbers.
Version II may be used for the much cheaper glass fibre web made on Karl Mayer stitchbonding machines.

Sub-project 2 - Shuttle base plate for new shuttle
FEM calculations for two base plates showed methods to be used for a further modification of the shuttle base plate. Grivory is a long fibre reinforced thermoplastic which may be used for absorbing centrifugal force loads as well as other force loads generated at the weft reacher-in, thanks to its higher flexibility based on a smaller modulus of elasticity and a lower rigidity-mass ratio (E/p). The material deforms more easily than AlMg. This is no disadvantage. Alternatively, different transfer mouldable plastics having a higher modulus of elasticity and rigidity-mass ratio (E/p) may be used, such as the carbon fibre reinforced thermoplast Celstran Lang CF-PA66-CF40-01 having a still smaller density and a double as high modulus of elasticity.

Sub-project 3 - Weft carrier
The design of this subassembly has no major weight saving potential. For this reason, one out of three versions was implemented. The solution involves a reduction of points of support from 5 to 3 and the re-design of the plates as compact hollow components.

Sub-project 4 - Yarn gripper
A stand for testing materials under near-practice conditions was developed. It was found that thermoplastic elastomers with well-balanced strength properties and a high melting

temperature of the hard component are more suitable than metals. Appropriate materials were identified and submitted to machine builders. Injection mouldings were manufactured and are being tested on various customers' premises. The results obtained to date under production conditions are positive and show that the new materials may secure longer service life times.
Partially crystalline thermoplastics offer two options : they are too soft and easily wearing, or they are wear resisting and too hard for thread clamping. Their possibilities of application in the yarn gripper may be improved by crosslinking their surfaces.

Application and economic advantages

Heald shaft/healds :
The various versions for heald shafts / healds (heald support) are available for testing and application in circular looms. In the meantime, the circular loom manufacturer has changed his plans, because, although the weight of the new heald supports was reduced, they are still too heavy by up to 60 per cent and apply too high a load on the drives. Therefore, the solution may not be used at all.

Shuttle base plate :
The results obtained are helpful in the development of the new base plate for the new shuttle.

Weft carrier :
The weft carrier is being transferred to series production.

Yarn gripper :
Injection mouldings are being tested on various customers' premises. Initial results obtained under production conditions show that the new materials provide longer service life times.

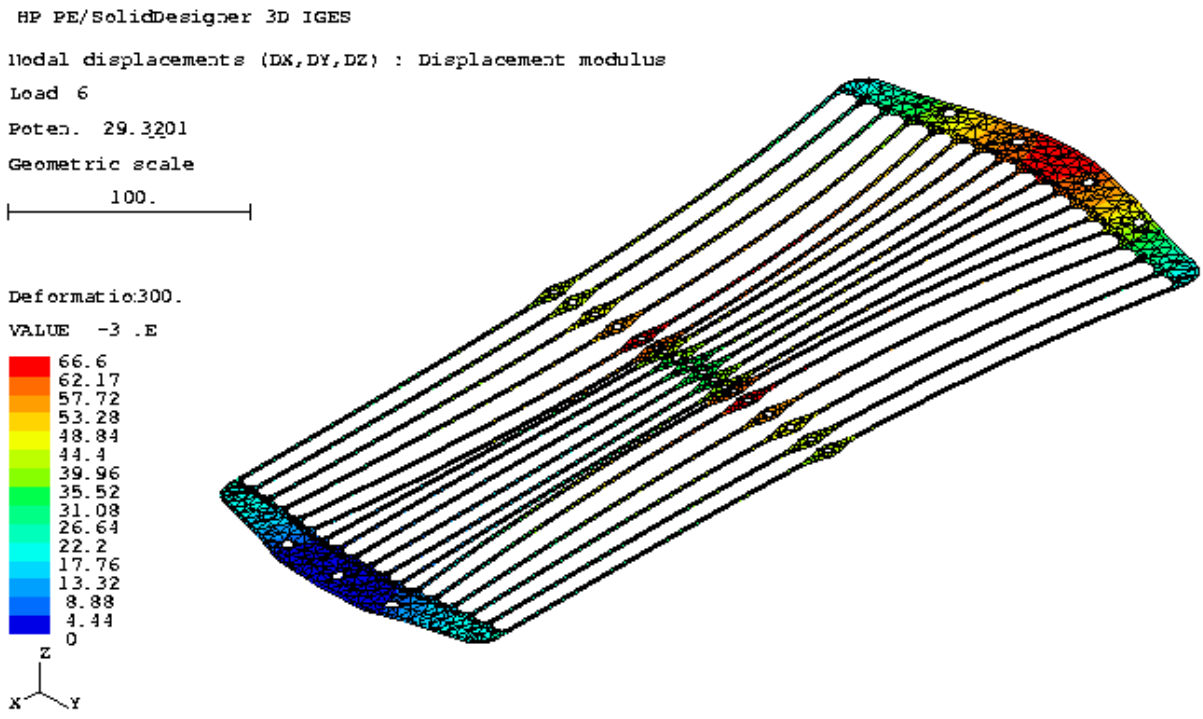

Figure: FEM deformation figure of a carbon fibre reinforced heald support under load of a belt expanding power