Modelling of the yarn-pull out process for the characterization of reinforcing woven fabrics

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Woven fabric is one of the most commonly used fibrous structures for reinforcing polymer composite products. Depending on the shape of the manufactured product, the reinforcing fabric may have to assume twice-curved surfaces. Such great deformations significantly influence the endurance and properties of composite structures. The deformability of the reinforcing fabric mostly depends on the friction among yarns, so these are very important to examine and analyse. One possible measurement method for these is the yarn pull-out test. Knowing friction, we can describe the behaviour of the fabric with models as close to reality as possible, and provide the basis for design, calculation and simulation.

During the yarn-pull-out test, the woven fabric has to be clamped on both sides, then parallel to the clamps we pull out one roving from the centre. During the pull-out process, the pull-out force and the displacement of the roving are measured. The yarn-pull out test can mainly be used to characterize the interaction among yarns.

The aim of the project was to test Vas's yarn pull-out model [1]. During the project eight glass woven fabrics from the same manufacturer were examined. Three pairs of glass fabrics had the same area density, but different weave patterns in each pair. The other two fabrics had approximately the same area density, but a special structure.

The presentation shows the examined materials, the measurement method applied and the results, Vas's yarn-pull out model and the results of the evaluations of the measurements.

On the one hand, we compared the values Vas's model provided with the actual measurement results, that is, we examined how precise predictions the model gives when certain attributes are known. On the other hand, based on the test results, we found connections between the length of the yarn in the woven fabric and the tensile force acting on the yarn.

All in all, we can conclude that the model describes the process of yarn pull-out well, so it can be applied for more complex woven fabric models and simulations.

Acknowledgments

References

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