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The FEM-prediction on Tensile Performance of Woven Membrane Materials Under Uni and Bi-axial Loads

Shou-Hui Chen[1,2*], Hong-Qin Yu[1,2], Zheng Guo[1,2], Raul Fangueiro[3], Da-Peng Qi[1]

[1]*College of Textile, Zhongyuan University of Technology, Zhengzhou, Henan, 450007, China*
[2]*Henan Key Laboratory of Functional Textiles Material, Zhengzhou, Henan, 450007, China*
[3]*Department of Textile Engineering, School of Engineering, University of Minho, Campus of Azurem, Guimaraes, 4800-058, Portugal*

Abstract: In this study, the mechanical model of the woven PVC-coated membrane materials has been built. By the FEM analysis, it was found out that when tensioned under uni-axial loads, the tensile modulus in the warp and fill direction of woven membrane materials could be predicted nicely, especially after the revision of the properties for the fiber materials. The effect of the tensile moduli of the fiber and the PVC coating materials on the modulus of the woven membrane fabrics has been discussed. It could be consulted that with the proper improvement of the modulus of the fiber materials in the fill direction, the discrepancy between the modulus of woven membrane materials in the warp and fill direction could be reduced to a certain extent. When it comes to the prediction of the modulus of the woven membrane materials under bi-axial loads, large difference could be noticed between the predicted results and the experimental results, especially in warp direction. This was due to the fact that the mechanical analysis model could only show the differences of the geometry configuration between the warp and fill directions. However, the reinforcement of membrane materials in warp direction during weaving and coating processes has been ignored.

Keywords: FEM, membrane materials, coated fabrics, tensile modulus, uni-axial, bi-axial

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*Corresponding author's email: island0410@gmail.com

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