

Секція 1

Новітні текстильні матеріали та технології

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DEVELOPMENT OF 3D MODELS OF A KNITTED STRUCTURE OF HIGH-STRENGTH THREADS

Purpose. Development and verification of the algorithm for 3D modeling of weft plain knitted fabrics made from ultrastrong raw materials in maximum tension under uniaxial loading.

Key words: weft plain knitted fabrics, uniaxial tensile, 3D modeling.

Objectives. The functional properties of protective knitwear products depend on the ability of materials to withstand the action of mechanical destructive factors. Optimization and enhancement of the design process of such materials can be realized by studying their physical and mechanical behavior and improving the means of creating their three-dimensional models. It is necessary to take into account the possibility of modeling of deformations and to work out a method of parameterization of a model, which provides a possibility of its adjustment to obtain samples of knitwear samples in a deformation state.

Methodology. The methods of three-dimensional geometric modeling and parameterization were used by the authors. An experimental verifying was carried out.

Research results. The issues of creating 3D models of knitted structures and simulation of their physical and mechanical behavior are widely discussed in scientific publications. In particular, the issues of modeling the elasticity of knitwear are focused on in works [1] etc. The paper [2] substantiates the choice of a 3D model of a knitted structure.

However, it was found out in the study that the geometric model described in [2] and embedded in the algorithms of Structura 3D software needs to be refined in order to allow modeling of knitwear under stretching. Thus, theoretical research

was carried out and the geometric model of a weft plain knitted structure under the maximum uniaxial stretching was described.

The authors provided samples of weft plain knits made from para-aramid threads and high molecular weight polyethylene threads (UHMWPE). *Fig. 1* shows fragments of knitwear structure models, based upon original data obtained by analyzing characteristics of the manufactured samples structure.

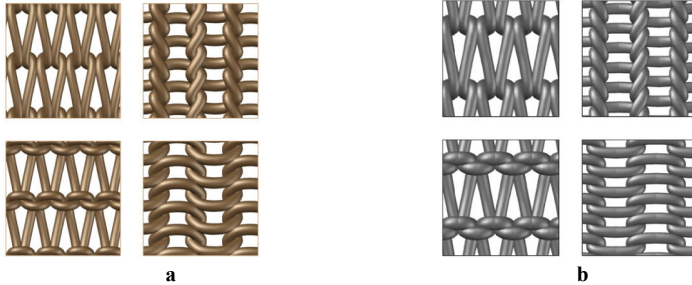


Fig. 1. 3D models of weft plain knits from para-aramid threads (a) and high molecular weight polyethylene threads (b)

Results obtained in the course of the research were added to Structura 3D program to enable modeling of knitwear products under the impact of tensile forces.

Conclusion. The research provided a geometric 3D model of weft plain knitted structures under uniaxial stretching. Functions of Structura 3D program were expanded by introducing the developed model into the program algorithm.

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