

# Development of the library for 3D modeling and computer-aided design of plated knitted fabrics

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## Introduction

3D technologies and computer-aided design (CAD) systems are used in various fields of human activity. 3D modeling allows to estimate the physical properties, appearance and other characteristics of products before they are made. The use of CAD systems reduces product cost, and automates the production process.

The task of developing a program for 3D modeling and computer-aided design of knitted fabrics is relevant. The program should be able to automatically create 3D models of knitted fabrics made of different raw materials. The fabrics yarns can be of different linear densities. The program should be able to calculate the structure parameters of knitted fabrics.

The work purpose is to develop program for 3D modeling and computer-aided design of plated knitted fabrics.

## Methods

To achieve this goal, we have set and solved the following tasks:

1. We represented the structure of single-layer plain knitted fabric by a geometric model [1].
2. We represented the structure of double-layer plated knitted fabric by a geometric model [1].
3. We created the basic parametric three-dimensional model of single-layer plain knitted fabric in the KOMPAS-3D system.
4. We created the basic parametric three-dimensional model of double-layer plated knitted fabric in the KOMPAS-3D system.
5. We created the visual interface of the program in the Embarcadero RAD Studio system using the C++ programming language.
6. We wrote program code to calculate the parameters of knitted fabric structure and rebuild the basic 3D models in the Embarcadero RAD Studio system using the C++ programming language.

## Conclusions

The program for 3D modeling and computer-aided design of single-layer plain knitted fabrics and double-layer plated knitted fabrics has been developed. It is advisable to use the library in the educational process to visually demonstrate to students the features of structure of knitted fabrics. The program was used by the authors in scientific research on the development of knitted fabrics with improved hygienic properties

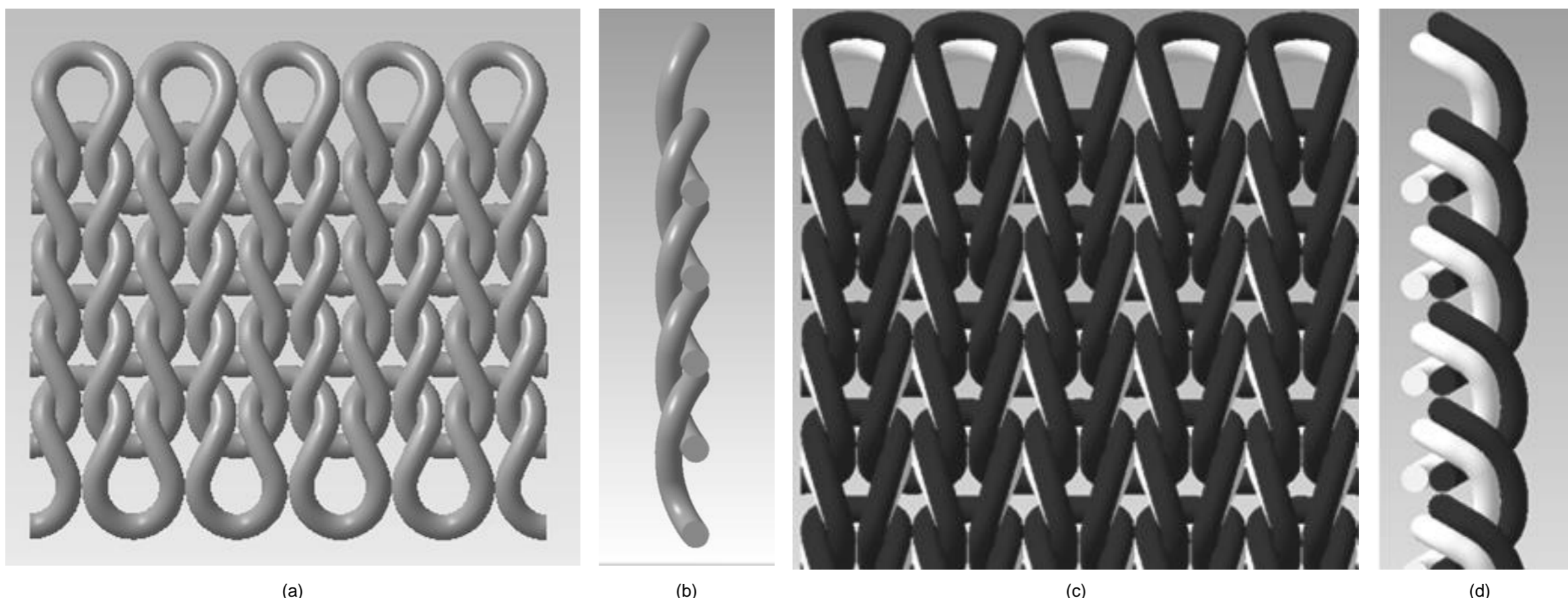
The program was developed as a library (external module) for CAD system KOMPAS-3D. The program algorithm is as follows:

- 1) allowing the user to select the stitch pattern of knitted fabric, raw material of yarns, linear density of yarns, set the number of courses and wales;
- 2) calculation of knitted fabric parameters based on the input data entered by the user;
- 3) connection to the KOMPAS-3D system installed on the user's computer;
- 4) opening of a base 3D model file in KOMPAS-3D system;
- 5) replacing the model variables with the new values calculated in step 2 and thus creating a new knitted fabric 3D model with custom parameters;
- 6) saving the new 3D model file to the hard drive;
- 7) display the calculated parameters of the knitted fabric on the screen;
- 8) allowing the user to save the values of these parameters to a text file.

The interface contains an element for selecting a knitted fabric structure (plain or plated), numeric fields for entering the linear density, elements for selecting the raw materials, a block with two numeric fields for entering the numbers of wales and courses, button "Build Model". Pressing the button launches the 3D model building process. Geometric parameters of knitted fabric structure are calculated in the program in accordance with [2]. Examples of 3D models built with the help of the library are shown in Pic.1 (a – single-layer plain knitted fabric; a – front view of the single-layer plain knitted fabric; b – side view of the single-layer plain knitted fabric; c – front view of the double-layer plated knitted fabric; d – side view of the double-layer plated knitted fabric).

## References

- [1] L. Kudryavin, I. Shalov, Fundamentals of knitting technology, Legprombytizdat, Moscow, Russia, p. 496, 1991.
- [2] A. Charkovskij, The basics of knitting processes, Vitebsk State Technological University, Vitebsk, Belarus, p. 165, 2005.



Pic.1. Geometric models of the knitted fabrics