

S00-AE06

FABRIC DESIGN AND ANALYSIS SYSTEM IN 3D VIRTUAL REALITY

Project Goals

The long-term goal is to develop a powerful and easy-to-use computer application program for designing 2D and 3D fabric structures and predicting their mechanical properties and performance in 3D shape applications. In order to eliminate first the manufacture and then the mechanical testing of a huge range of potential samples for a given engineering application, a fully integrated computer-based design, analysis and manufacture system is required. Our goal is to develop such an integrated computer-based design system that enables geometric models for woven fabric structures in three dimensions, which would allow engineers to simulate new textile forms in virtual reality and to study the effects of the process parameters on the basic underlying textile structure.

Technical Approach

The following figures show graphical representations of weft structure in fabric (Figure 1) and the two layer fabric (Figure 2).

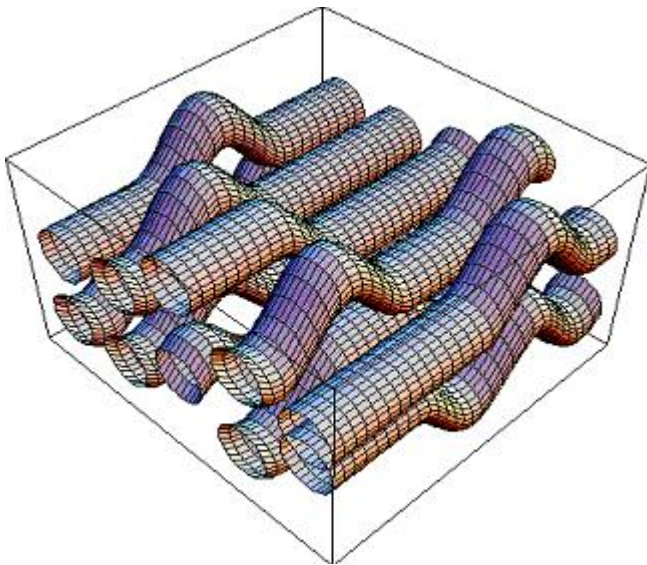


Figure 1. Weft yarn structure in two layer fabric.

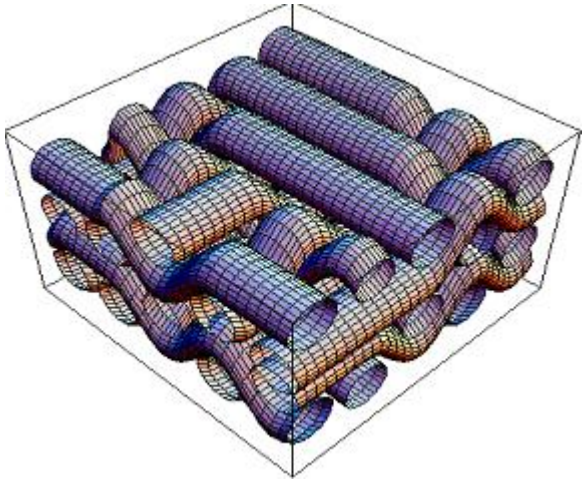
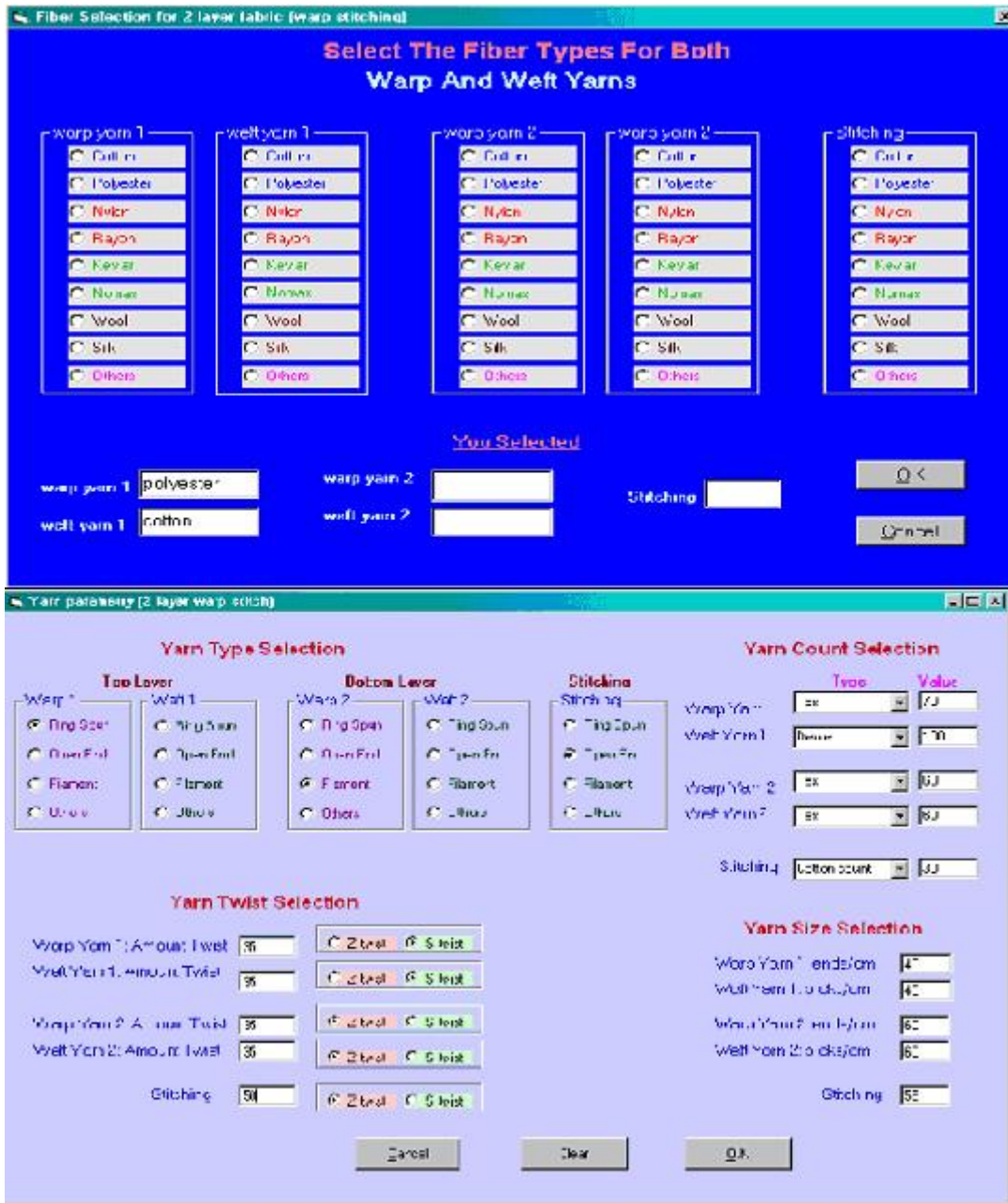


Figure 2. Two layer fabric structure

Significant progress has been made in developing the new computer software at Auburn University, Department of Textile Engineering named as “Fabric 3D Design and Analysis System”. This software has the following functions:

- Fabric input value selection
- Fabric weave pattern design
- Fabric 2D and color weaving design
- Fabric 3D structure simulation

Fabric input value selection consists the forms to input the data of the fibers selected and the yarn parameters like yarn type, its twist, twist direction, count and ends and picks/inch. Figure 3 shows the frames to input fiber and yarn parameters.



Fabric weave pattern design consists of the frames where the user can give the weave design for single layer, two layer and three layer fabrics (Figure 4). The path of the yarn can be seen simultaneously which makes the user easy to understand and gives the flexibility to change the design at any time. Each layer has its own pattern diagram and the combined effect can be seen in the yarn path diagram, which removes the complexity in designing the fabric.

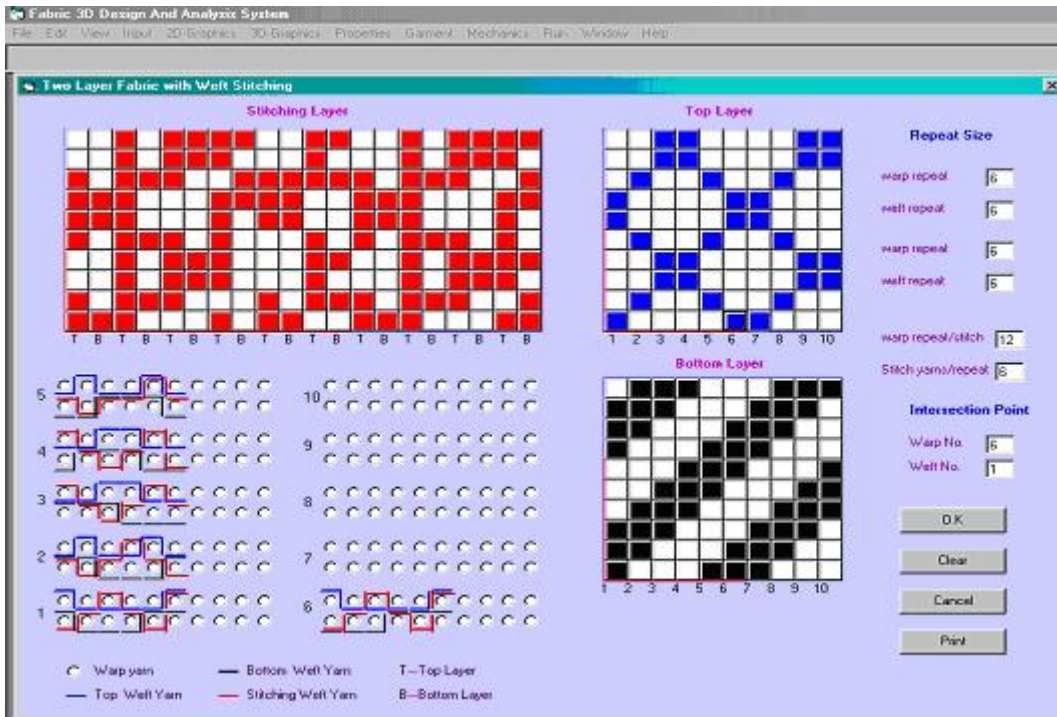


Figure 4. Fabric weave pattern design

Fabric 2D and color weave design gives the output in the 2D structure (Figure 5). Here the user will have the options to change the color of warp and weft yarns, can view individual yarns and can view the structure at different magnification ratios and different sizes of the fabric.

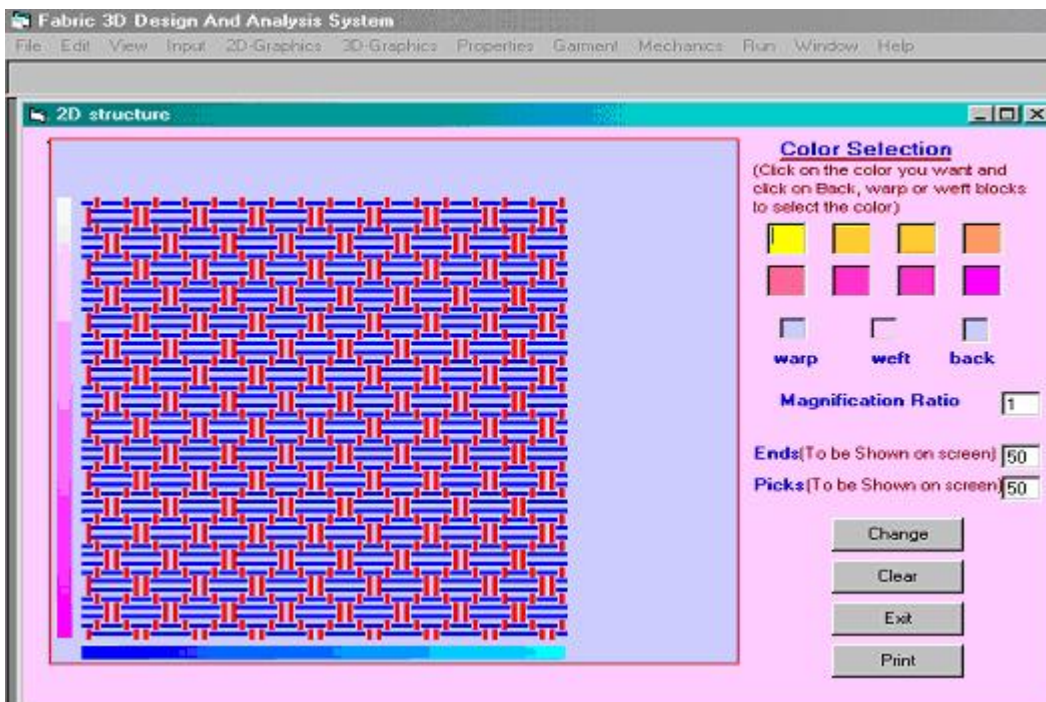


Figure 5. Fabric 2D and weave color design

Fabric 3D structure simulation gives the simulated 3D graphic output of the fabric structures. The user will have the options to see the fabric structure, warp yarns structure and weft yarns structures at different angles (Figure 6).

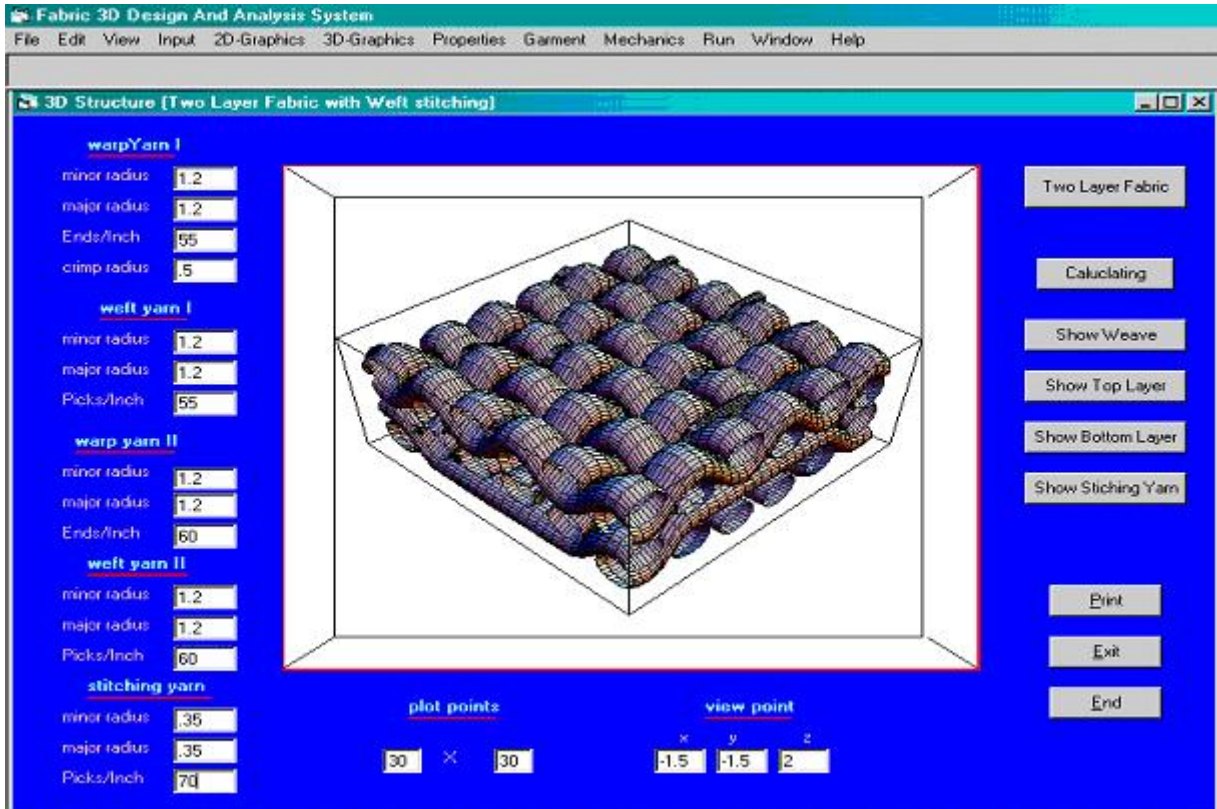


Figure 6 Fabric 3D structure simulation

The properties like fiber thickness, fabric weight, fabric density, % crimp level, % open area, % take-up, cover factor, packing factor, porosity etc., can be calculated.

Acknowledgment

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