

DEVELOPMENT OF THE TECHNOLOGICAL DESIGN DIAGRAM OF A FINE-PATTERN-FORMING SHADOW TWILL WEAVE

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Abstract: *This article is devoted to the development of a technological design diagram for a fine-pattern-forming shadow twill weave. The study focuses on the analysis of structural and technological parameters of the designed fabric, including yarn linear density, warp and weft densities, weave repeat, surface density, and yarn crimp. Modern fabric design software was used to model the weave structure, and experimental samples were produced on weaving looms. The results demonstrate that the proposed shadow twill weave provides high aesthetic properties, sufficient strength, good shape retention, air permeability, and comfort, making it suitable for apparel, interior, and decorative textile applications.*

Keywords: *shadow twill weave, fine-pattern weave, fabric design, technological design diagram, surface density, textile materials.*

Аннотация. *Статья посвящена разработке технологической расчетной схемы мелкоузорчатого переплетения типа «тенивая саржа». В работе рассмотрены структурные и технологические параметры проектируемой ткани, включая линейную плотность нитей, плотность по основе и утку, раппорт переплетения, поверхностную плотность и уработку нитей. Проектирование структуры переплетения выполнено с использованием современных программных средств, после чего экспериментальные образцы были выработаны на ткацких станках. Полученные результаты подтверждают, что разработанное переплетение обеспечивает высокие эстетические показатели, достаточную прочность, хорошую формоустойчивость, воздухопроницаемость и комфортность, что позволяет рекомендовать данную ткань для изготовления одежды, интерьерных и декоративных текстильных изделий.*

Ключевые слова: *тенивая саржа, мелкоузорчатое переплетение, проектирование ткани, технологическая расчетная схема, поверхностная плотность, текстильные материалы.*

In the Development Strategy of New Uzbekistan for 2022–2026, based on the principle “*From the Action Strategy to the Development Strategy*”, a number of goals and objectives have been defined aimed at further improving the welfare of the population, transforming economic sectors, accelerating entrepreneurship development, ensuring human rights and interests, and forming an active civil society through a deep analysis of complex

global processes and the development path achieved by the country [1]. These include, in particular:

- Increasing the volume of services by three times over the next five years through the development of service sectors in the regions and creating a total of 3.5 million new jobs in this area;
- Creating new jobs in the country, increasing population income, and thereby reducing poverty by at least two times by the end of 2026;
- Doubling the production volume of textile industry products (to USD 13.0 billion) and tripling labor productivity (to USD 20,000), as well as developing and implementing a program to increase textile production and export volumes during 2022–2026.

In this context, mastering new product types and technologies is of primary importance, which ensures the competitiveness of national goods in both domestic and foreign markets.

Under market economy conditions, the growing demand for high-quality finished products requires not only an increase in the number of modern equipment installed at industrial enterprises but also their rational and efficient utilization.

The implementation of product quality management systems and ensuring compliance with international standards has not yet been fully resolved at all enterprises. This shortcoming is especially relevant for consumer goods manufacturing sectors of critical importance, such as the light industry, pharmaceutical industry, and construction materials industry [2].

Despite scientifically grounded approaches and significant achievements in fabric production developed by researchers and specialists, production-related challenges still persist. In order to significantly reduce the demand for expensive natural textile raw materials and decrease the share of garments produced from chemically obtained raw materials, the production of new types of textile products by blending relatively In the Development Strategy of New Uzbekistan for 2022–2026, based on the principle “*From the Action Strategy to the Development Strategy*”, a number of goals and objectives have been defined aimed at further improving the welfare of the population, transforming economic sectors, accelerating entrepreneurship development, ensuring human rights and interests, and forming an active civil society through a deep analysis of complex global processes and the development path achieved by the country [1]. These include, in particular:

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Theoretical studies were conducted to analyze factors influencing the surface appearance of fabrics based on existing theories. Practical research was carried out using modern fabric design software, followed by sample production on weaving looms and analysis of quality indicators.

Table 1

Results obtained based on fabric design according to surface density

No.	Parameters	Unit	Experimental	Designed
1	Warp yarn linear density, TT	tex	25×2	25×2
2	Weft yarn linear density, TA	tex	28×2	28×2
3	Warp yarn density in fabric, PT	yarn/dm	210	210
4	Weft yarn density in fabric, PA	yarn/dm	180	180
5	Number of yarn interlacings per repeat, ch ₁ , ch ₂	—	2	2
6	Number of warp floats, tt	—	2	2
7	Number of weft floats, ta	—	2	2
8	Warp repeat of weave, RT	yarn	4	4
9	Weft repeat of weave, RA	yarn	12	12
10	Calculated fabric surface density, mTn	g/m ²	230	229
11	Warp yarn crimp for new weave, at	%	17.5	17.5
12	Weft yarn crimp for new weave, aa	%	9.45	9.45

Fabric Description

The shadow twill fabric is produced from blended yarns. The linear density of warp yarns is **Tt = 50 tex**, while the linear density of weft yarns is **Ta = 56 tex**. The warp yarn density is **Pt = 210 yarns/dm**, and the weft yarn density is **Pa = 180 yarns/dm**. The surface density of the fabric is **230 g/m²** [3].

Shadow twill is a special type of twill weave in which, due to the specific arrangement of yarns, shaded, diagonal lines and color transition effects are formed on the fabric surface. Such fabrics are widely used in garment manufacturing, upholstery materials, and decorative textiles.

This study provides detailed information on the structure, properties, production process, and application areas of shadow twill fabrics [4].

Shadow twill is characterized by the formation of shading effects on the fabric surface through variations in color, yarn thickness, or weaving density. Depending on light incidence, different levels of color transitions can be observed.

The main characteristics of shadow twill fabrics include:

- Formation of shaded (gradient-like) visual effects on the fabric surface;
- Attractive and aesthetically pleasing design;
- Wide application in the fashion industry;
- Possibility of production in various color combinations.

The designed shadow twill weave belongs to the group of fine-pattern-forming weaves and creates diagonal shaded and decorative effects on the fabric surface. The technological parameters of the fabric were selected as follows: warp yarn linear density $Tt = 50$ tex, weft yarn linear density $Ta = 56$ tex, warp density $Pt = 210$ yarns/dm, and weft density $Pa = 180$ yarns/dm [5].

According to the results of the Technological Design Diagram (TDD), the weave repeat is $Rt = 4$ in the warp direction and $Ra = 12$ in the weft direction. The interlacing of warp and weft yarns ensures the formation of a regular shadow pattern on the fabric surface. A high number of warp floats allows the diagonal twill lines to be clearly visible on the face side of the fabric, enhancing its aesthetic appearance.

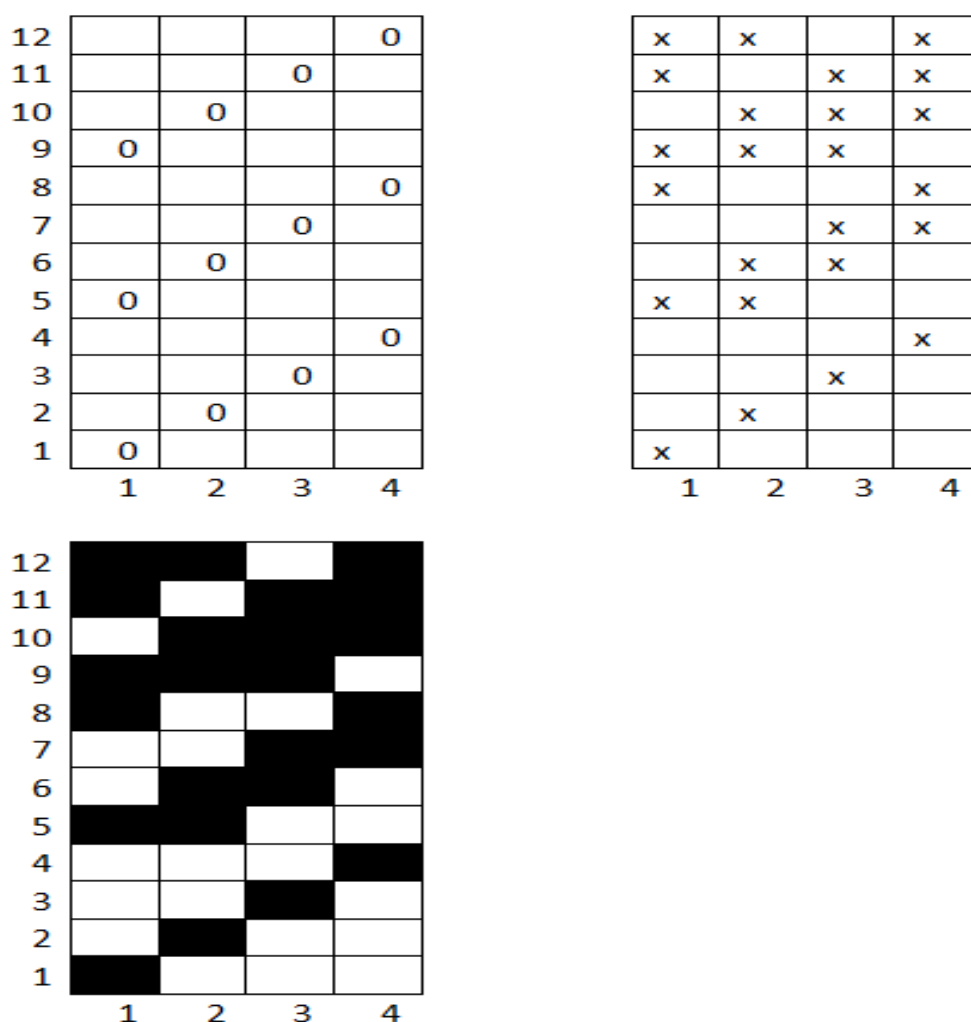


Figure 1. Structural diagram of a fine-pattern-forming shadow twill weave

The fabric obtained based on the calculated and selected parameters has a surface density of **230 g/m²**, indicating sufficient strength, good shape retention, and high performance properties. In addition to decorative qualities, the shadow twill weave provides good air permeability, softness, and wearing comfort.

Thus, the developed fine-pattern-forming shadow twill weave is considered suitable for the production of modern garments, interior, and decorative textile products. Fabrics produced based on this weave are distinguished by high aesthetic characteristics, durability, and favorable consumer properties and are recommended for wide application in the textile industry.

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