Volume : 2 | Issue : 4 | Received-25-07-2026 | Accepted-29-07-2026 | Published-02-08-2026

UAI JOURNAL OF EDUCATION, HUMANITIES AND LITERATURE (UAIJEHL)

Abbreviated Key Title: UAI J Eud Huma Lit.
ISSN: 3049-3196 (Online)
Journal Homepage: https://uaipublisher.com/uaijehl-2/
Volume- 2 Issue- 4 (July – August) 2026
Frequency: Bimonthly

Discussion on the Process Control of Set-in Sleeve Angle for Womenswear

WU Fan[1], Fang Yuanyuan[2], LI Yi[3], Xu Benqing[4], Li Qiankun[5], Chen Zhongshan[6*]

[1] Guangzhou Mini Garment Co., Ltd., Guangzhou,Guangdong,510000, China.
[2]Yumo Apparel (Hangzhou) Co., Ltd.,Hangzhou, Zhejiang ,310000,China
[3] Hangzhou Xingyou Garment Co., Ltd. Hangzhou,Zhejiang, 310000,China.
[4] Zhongfu Chengzhi Artificial Intelligence Technology (Hangzhou) Co., Ltd., Hangzhou, Zhejiang, 310000, China.
[5]Hangzhou Hancheng E-commerce Co., Ltd., Hangzhou, Zhejiang, 310000, China

Corresponding Author: Chen Zhongshan

ABSTRACT

The sleeve structure plays a key role in womenswear pattern design, and the proper determination of sleeve angle directly affects the fit and wearing comfort of the finished garment. This paper starts with the two types of sleeve angles in set-in sleeves, discussing respectively the formation mechanisms and constraining factors of the vertical arm-raising angle and the forward-backward inclination angle of the sleeve. By analyzing the corresponding relationship between sleeve cap height and sleeve width, the indirect influence of armhole morphology on sleeve angle, and the inclination angle data of the human arm in its natural hanging state, combined with pattern-making practice, this paper proposes specific control methods and adjustment principles for sleeve angle determination. This paper holds that the determination of sleeve angle requires comprehensive consideration of multiple factors including fabric properties, wearing scenarios, human body structure, and style design. Fixed values alone cannot meet the actual pattern-making requirements, and systematic flexible adjustments should be made on the basis of standard reference values.

KEY WORDS: Womenswear sleeves; Sleeve angle; Sleeve cap height; Sleeve width; Armhole morphology; Forward inclination angle; Pattern-making control.

1. Introduction

The sleeve structure occupies an important position in the overall womenswear pattern design, and whether its angle setting is reasonable is directly reflected in the smoothness of the finished garment's appearance and the ease of movement during wearing. In set-in sleeve construction, two types of angle issues are generally involved: one is the forward-backward inclination state of the sleeve on the garment body under static conditions, that is, the degree of deflection of the sleeve relative to the coronal plane of the human body when hanging naturally; the other is the vertical range of motion of the sleeve when the arm is raised laterally, that is, the change in the gap between the sleeve tube and the human body during arm lifting. These two types of angles correspond to fit and comfort respectively. They are both independent of each other and internally related, and need to be considered comprehensively during the pattern-making process.

DOI: 10.5281/zenodo.21755755

2. Factors Constraining the Vertical Arm-Raising Angle

The magnitude of the arm-raising angle is essentially determined by the proportional relationship between sleeve cap height and sleeve width. Sleeve cap height refers to the vertical distance from the sleeve crown point to the sleeve width line after the sleeve piece is folded, while sleeve width is the transverse dimension at the widest part of the sleeve piece. Under the premise that the armhole depth remains unchanged, changes in sleeve cap height will cause corresponding changes in sleeve width, thereby altering the gap between the sleeve tube and the human body, and ultimately affecting the range of motion during arm raising.

When the armhole depth is fixed, an increase in sleeve cap height leads to a corresponding decrease in sleeve width, narrowing the distance between the sleeve tube and the arm. The sleeve becomes slimmer overall and appears more fitted in static condition, but lateral arm raising is significantly restricted, and a pulling sensation is likely to occur in the underarm area. Conversely, when sleeve cap height is reduced, sleeve width increases, leaving more space between the sleeve tube and the human body, allowing more freedom in arm raising. However, the sleeve silhouette becomes looser, the crispness of appearance decreases, and excess wrinkles may appear at the sleeve cap.

From the numerical relationship perspective, for every approximate 0.4 cm increase in sleeve cap height, sleeve width decreases by about 1.3 to 1.4 cm. This proportion can serve as a reference basis for preliminary calculation in pattern-making. In long-term industry practice, when the sleeve cap height is about one-third of the armhole circumference (AH), the arm is in a moderate position between static and dynamic states, with the raising angle at approximately 45°. Therefore, AH/3 is commonly used as the starting point for calculating the standard sleeve cap height (as shown in Figure 1)[1][2].

However, it should be noted that this value is only applicable to the initial pattern setting for conventional styles and ordinary woven fabrics, and is not suitable for all situations. Factors such as fabric thickness, warp and weft shrinkage rate, and elastic modulus will all affect the actual coordination relationship between sleeve cap height and sleeve width. Elastic fabrics allow the sleeve cap to be appropriately raised without excessively restricting movement, while stiff or non-stretch fabrics require a moderate reduction in sleeve cap height to ensure basic arm-raising function. In addition, when the armhole depth changes due to style requirements, the inverse relationship between sleeve cap height and sleeve width no longer holds, and the matching values between the two need to be recalculated.

Changes in armhole morphology also have an indirect but significant impact on the arm-raising angle. Increases or decreases in armhole depth directly change the coordination position between the sleeve cap and the garment body: when the armhole is deepened, the side seam of the garment body moves downward, and the sleeve cap needs to be adjusted accordingly to maintain the matching relationship between the armhole circumference and the sleeve cap circumference; otherwise, the sleeve angle will shift. Changes in armhole width affect the distribution of horizontal space at the bottom of the sleeve cap. If the armhole is too narrow, even with sufficient sleeve width, the underarm area will still feel constrained during arm raising; if the armhole is too wide, excess gaps will appear between the sleeve cap and the garment body, resulting in a loose sleeve silhouette. Therefore, before determining the arm-raising angle, the basic shape of the armhole must be established first, and on this basis, fine adjustments to the sleeve cap height and sleeve width should be made.

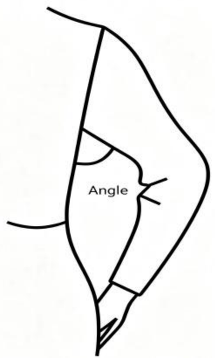

Figure 1 Schematic diagram of vertical arm-raising angle and the relationship between sleeve cap height and sleeve width

3. Control Methods for the Forward-Backward Inclination Angle of Sleeves

The forward-backward inclination angle of the sleeve on the garment body mainly depends on the gradual setting of sleeve width inclination, elbow curvature, and cuff offset during pattern-making, with its basis derived from the natural morphology of the human upper limb (as shown in Figure 2).

When the human body stands naturally with arms relaxed and hanging down, the upper limb is not completely perpendicular to the ground but exhibits a slight forward-inclining physiological feature. Specifically, the angle between the perpendicular line from the shoulder joint point to the ground and the line connecting the shoulder joint to the wrist joint is approximately 6°, which determines the forward inclination of the upper sleeve section. Meanwhile, the angle between the line connecting the wrist and elbow joints and the shoulder perpendicular line is approximately 12.5°, which is used to determine the curvature of the elbow in the lower sleeve section (as shown in Figure 3). These two sets of angles are the biological basis for the forward-backward inclination of the sleeve, and pattern-making should be based on these data for structural design.

Shoulder slope angle is another important variable affecting the forward-backward angle of the sleeve. The shoulder slope of the human body is not fixed; it varies among different body types, generally ranging between 18° and 22°. When the shoulder slope is larger, the curvature of the sleeve cap curve needs to be correspondingly increased to ensure accurate alignment between the sleeve crown point and the shoulder endpoint; otherwise, the entire sleeve will shift backward. When the shoulder slope is smaller, the sleeve cap curve can be appropriately flattened, and the forward inclination of the sleeve needs to be supplemented through sleeve width inclination. If the linkage between shoulder slope and sleeve angle is ignored during pattern-making, even if the sleeve width and sleeve cap height data are accurate, the finished garment's sleeves may still appear skewed or suspended[3].

In actual operation, the control of the forward-backward angle can be broken down into three steps.

The first step is to determine the inclination direction of the sleeve width line, thereby ensuring that the overall sleeve has a reasonable

DOI: 10.5281/zenodo.21755755

forward-inclining tendency. This step determines the basic orientation of the sleeve after assembly with the garment body. If the inclination is insufficient, the sleeve tube will be too upright and not conform to the natural posture of the human body; if the inclination is excessive, the sleeve tube will rush too far forward, destroying the overall balance (as shown in Figure 4).

The second step is to set appropriate curvature near the elbow line based on elbow inclination data, so that the sleeve tube shape is consistent with the natural bending direction of the arm, avoiding diagonal wrinkles at the elbow during wearing. The treatment of elbow curvature should pay attention to smooth transition, avoiding abrupt turns in localized areas that would affect the aesthetic appearance of the sleeve (as shown in Figure 5).

The third step is to distribute the front and back offsets at the cuff, so that the entire sleeve forms a smooth transition from the shoulder endpoint through the elbow to the cuff, rather than a mechanical straight-line shape. The distribution of cuff offsets should balance the front and back, with the front offset slightly larger than the back to conform to the forward-inclining tendency of the arm (as shown in Figure 6).

In addition, the distribution ratio of back width to front chest width also affects the forward-backward angle of the sleeve. When the back width dimension is relatively increased, the forward inclination of the sleeve correspondingly increases, and pattern-making needs to weigh this in combination with specific measurements. The ratio of front chest width to back width also affects the shape of the armhole, thereby indirectly affecting the curvature of the sleeve cap curve. This is a link that is easily overlooked in pattern-making but has a significant actual impact[4].

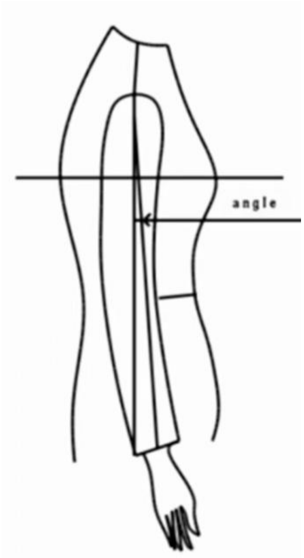

Figure 2 Schematic diagram of sleeve forward-backward inclination angle under static condition

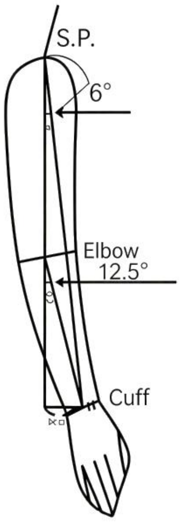

Figure 3 Human body angle data

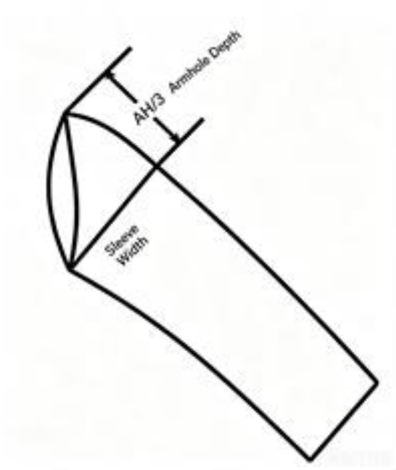

Figure 4 Sleeve width and sleeve cap inclination control

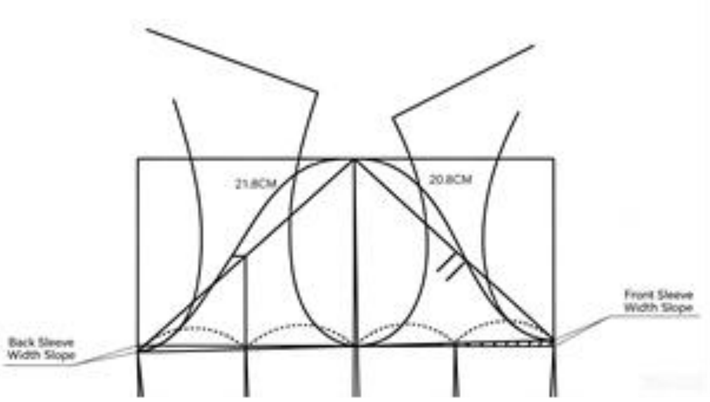

Figure 5 Sleeve width and sleeve cap inclination control

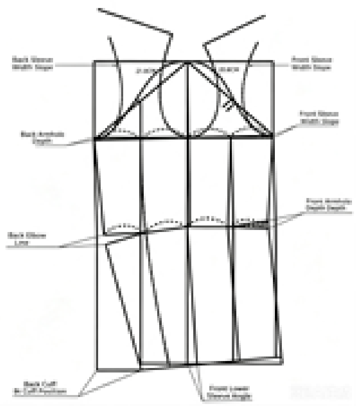

Figure 6 Overall sleeve completion diagram

4. Constraints of Fabric Properties on Sleeve Angle Adjustment

As the material carrier for achieving sleeve angle, the physical properties of fabric have an important impact on the final determination of sleeve cap height and sleeve width, a point that is often overlooked in actual pattern-making.

Fabric thickness directly affects the ease allowance of the sleeve cap curve. For thick fabrics such as woolen fabrics and coated fabrics, the ease allowance of the sleeve cap curve should not be too large; otherwise, the sleeve cap area will appear bulky and accumulated, the sleeve angle will become blurred, and resistance during arm raising will increase. For thin fabrics such as silk and cotton-linen, the sleeve cap can withstand greater ease allowance, and the sleeve cap height can be appropriately increased to make the sleeve silhouette more crisp.

DOI: 10.5281/zenodo.21755755

The difference in fabric elasticity is even more significant: for fabrics with greater weft elasticity, the sleeve width can be appropriately narrowed without affecting arm-raising function; for non-stretch fabrics, sufficient range of motion must be reserved; otherwise, obvious pulling will occur at the underarm and back sleeve seam during arm raising.

The warp and weft shrinkage rate of fabrics also needs to be considered during the pattern-making stage. For fabrics with greater shrinkage rates, the sleeve cap height and sleeve width dimensions will both change after washing, and the sleeve angle will shift accordingly. Therefore, before finalizing the sleeve angle, fabric shrinkage testing must be completed first, and the shrinkage rate should be incorporated into the calculation of sleeve cap height and sleeve width. In actual production, this link is often compressed, resulting in deviations between the finished garment and the sample pattern, and the sleeve angle failing to achieve the expected effect.

5. Application of Digital Tools in Sleeve Angle Verification

With the gradual popularization of CAD pattern-making and 3D fitting technology in the garment industry, the verification method of sleeve angle has been significantly improved compared to traditional methods.

In traditional pattern-making, sleeve angle verification mainly relies on flat pattern dimension checking and physical muslin sample try-ons, which have a long cycle and high modification costs. 3D virtual fitting technology can stitch 2D pattern pieces into a 3D model before sample garment sewing, intuitively displaying the natural hanging state and arm-raising angle range of the sleeve on the mannequin. By rotating viewpoints and adjusting postures, the pattern maker can identify issues such as insufficient sleeve cap height causing restricted arm raising or excessive sleeve width causing a bulky appearance in advance, and directly modify the pattern piece parameters in CAD software, then import them into 3D software for secondary verification.

However, it should be noted that the fabric simulation parameters in 3D software need to correspond to the actual fabric properties; otherwise, the virtual fitting results will lack reference value. The advantage of digital tools lies in improving verification efficiency and reducing material consumption, but they cannot replace the pattern maker's judgment of human body structure and fabric characteristics^[4]^. The final determination of sleeve angle still needs to be based on actual sample garment try-ons, and digital tools should be positioned as auxiliary means rather than decision-making bases.

6. Conclusion

Sleeve angle is one of the core parameters in womenswear set-in sleeve structural design. The vertical arm-raising angle is mainly constrained by the matching relationship between sleeve cap height and sleeve width, while also being affected by armhole depth, armhole width, and fabric properties. Its regulation needs to be systematically adjusted based on specific conditions, using the standard reference value AH/3 as a starting point. The forward-backward inclination angle of the sleeve is based on the inclination data of the human upper limb in its natural hanging state, and is achieved through step-by-step setting of sleeve width inclination, elbow curvature, and cuff offset, while also taking into account the comprehensive effect of shoulder slope angle and the chest-back width ratio.

In actual pattern-making practice, the two types of angles should not be treated in isolation but should be regarded as an interrelated whole. The setting of armhole morphology, the physical properties of fabrics, and the style requirements all have overlapping effects on sleeve angle, and adjustment of any single factor may trigger cascading changes in sleeve angle. With the popularization of digital tools such as CAD and 3D fitting in the garment industry, the verification and correction of sleeve angles have become more intuitive and efficient. However, tools themselves cannot replace in-depth judgment of human body structure and fabric properties. Pattern makers should, on the premise of understanding basic principles, apply them flexibly in combination with practical experience, so as to achieve a reasonable balance between fit and comfort.

References

1. Liu Ruipu. Principles and Applications of Fashion Design (Womenswear Volume)[M]. Beijing: China Textile Press.
2. Zhang Wenbin. Structural Design Section of Garment Technology[M]. Beijing: China Textile Press.
3. Zhang Xiaochong. Solutions to Pattern-Making Difficulties[M]. Shanghai: Shanghai Scientific and Technical Publishers.
4. Wu Jingxiong. Intercommunication Between Draping and Flat Pattern Making[M]. Shanghai: Shanghai Culture Publishing House.

DOI: 10.5281/zenodo.21755755