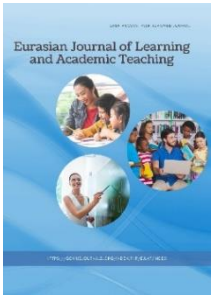

Clothes With Improved Ergonomic Parameters For Military Women

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ABSTRACT

The design of special-purpose clothing is a complex task, the solution of which requires an integrated approach that takes into account the increased requirements for the operational characteristics of manufactured clothing, as well as the results of a comprehensive analysis of the current requirements of potential consumers, which are associated with the peculiarities of their professional activities and high risks of their life safety arising when performing military women's official tasks.

Keywords: Computers, technology, design, ergonomic, structural, military, biomechanical.

The use of new computer technologies ensures the effective use of biokinematic characteristics of human movements, allows one to abandon routine operations on planar modification of the original templates of shoulder clothing parts, there by creating the possibility of actively creating a volumetric solution for clothing with a given level of dynamic compliance.

At the same time, the expenditure of time and material resources on the design of basic and initial model clothing structures is significantly reduced, which is of particular importance in the modern economic conditions of insulated clothing with improved ergonomic parameters for female military personnel.

Research on optimization of design parameters to ensure the ergonomics of clothing designs is described in the works of outstanding Russian scientists E.B. Koblyakova, E.Ya. Surzhenko, L.H. Faritova, E.Yu. Bakhtina.[1]

The essence of designing ergonomic clothing is to find such design parameters, ergonomic parameters for military women, which ensure a high level of dynamic compliance of the designed products. The parameters found ensure the product is convenient to use and reduces the cost of lengthy design development. Thus, in the works of Professor Koblyakova E.B. and the students of her school, a significant amount of research has been carried out to optimize the design parameters of various assortments of household clothing. A number of patterns have been derived for military women in the design of ergonomic clothing and design parameters, research methods, installations for their implementation, and a methodology for comprehensive assessment of the quality of designed clothing have been developed.[2]

Scientific research carried out under the guidance of Professor E.Ya. Surzhenko is devoted to solving the problems of increasing the ergonomic compliance of special-purpose products.[3]

The works consider and describe an approach to the design of special clothing

based on biokinematic analysis of the interaction of elements of the "man-clothing" system.

A classification of labor movements of workers has been developed, polynomial dependences of changes in the dynamic effects of dimensional characteristics of figures on the angular biomechanical characteristics of human body movements in the main joints have been established. A methodology has been developed for biokinematic analysis and assessment of the ergonomics of workwear structures based on film and videograms of 28 movements of a dressed person, using analytical methods for studying the kinematic parameters of the movements of mechanism links.

Methodological recommendations have been developed for optimizing the ergonomic parameters of the basic designs of special clothing, taking into account the characteristic or extreme labor movements of female military personnel. This approach makes it possible to obtain design parameters with a given level of dynamic compliance, but is quite labor-intensive.

In the work of E. Yu. Bakhtina, methods for designing and assessing the ergonomics of special clothing designs for women military personnel were reviewed and improved. The essence of the work is to create methodological support for three-dimensional ergonomic design of special clothing, allowing to reduce time, material and labor costs for the development of products with a given dynamic compliance with extreme human movements. It has been established that the value of the design parameters of product parts depends on changes in the size and shape of the surface of the human body during various types of movements. Changes in the sizes of human body segments were obtained during anthropodynamic studies, quantitative characteristics of angular and linear biomechanical parameters were established.[1]

Research into the mechanism of interaction of elements of the human clothing system in dynamics was carried out by superimposing images of the contour lines of the human body in various phases of movement, which made it possible to establish the trajectories of movement of the main points of the body surface and determine the main areas of the surface that affect the change in its shape. The results obtained are taken into account in the designed structure by increasing the linear dimensions of the product parts. Based on the data obtained, taking into account a complex of extreme movements in service combat situations, a set of insulated field clothing for female military personnel has been developed.[1]

In the work of Machinskaya Yu.V. carried out under the guidance of E.Ya. Surzhenko, an algorithm for ergonomic analysis of design solutions for workwear was proposed and the dependence of changes in the dynamic effects of dimensional characteristics of women's figures on the angular biomechanical parameters of movements in the main joints was established. Taking into account the functional ergonomic characteristics of workwear, a structured database of reference information has been created to determine compliance with operating conditions. The developed methodology for ergonomic analysis, synthesis and evaluation of structural and compositional solutions for workwear is practically implemented using the example of women's overalls.[4]

During the analysis of the project situation in the field of three-dimensional clothing design, it was revealed that there are modern non-contact three-dimensional scanning measuring systems that make it possible to obtain reliable information about the dimensional characteristics of the human body in statics and dynamics. In MGUDT by I.A. Petrosova. a methodology has been developed for designing the external form of clothing based on three-dimensional scanning.[5]

The developed 3D scanning system provides the designer with the opportunity to interactively scale the model, placing it in the required angle for more accurate positioning of anthropometric points, and take measurements of selected areas of virtual models of typical figures or individual figures. By means of virtual modeling of movements, data on dynamic changes in the external shape of the

body, characteristic of active human activity, are systematized, which makes it possible to make an informed choice of design increases for freedom of movement when designing clothes with increased ergonomic requirements.

Work by Surikova O.V. is dedicated to improving the quality and manufacturability of clothing based on the optimization of basic elements 30 of clothing design. A systematization of clothing design elements and indicators of their properties was carried out, controlled parameters and optimization criteria for structural elements were determined, and a methodology for designing rational parameters of basic structural elements using artificial intelligence systems was developed.[6]

In this work, to assess the comfort of clothing in dynamics, it is proposed to use the size of the friction zone at the points of contact of the limbs and torso of a person. A device has been developed that simulates the movement of the hand while walking. The human torso was photographed to study the trajectory and speed of movement, the friction zone and the pressure of the hand on the body.[7]

The work is devoted to the study of the human figure in dynamics during heavy lifting to develop clothing for the prevention of occupational diseases of the musculoskeletal system, insulated clothing with improved ergonomic parameters for female military personnel. The acceleration and angular velocity of the human limbs and body are analyzed. A vest with five sensors was developed for the study. During movement, the sensors register and transmit to the computer information about the position of the body and angular velocity.[8]

The study developed mathematical models to find the necessary increases and design functional clothing. Research into the interaction of the "person-clothing-environment" system in statics and dynamics is currently carried out using contact and non-contact methods.

American scientists from the Department of Clothing, Kansas State University conducted research and developed methodological recommendations for finding dynamic effects based on studying the operating conditions of clothing and characteristic movements. Thus, there is a fairly large number of studies devoted to improving the ergonomics of clothing for various purposes for female military personnel.

However, employees of a special forces detachment perform special functional duties that combine not only combat training, but also mountaineering skills; therefore, there must be a special approach to the design of clothing of this type, taking into account the peculiarities of movement of employees of special forces, along with operating conditions and specific requirements to designed clothing.

The analysis showed that existing methods for designing special clothing do not fully satisfy the problem of designing ergonomic clothing for special forces for mountain conditions. The lack of regulatory documentation regulating the requirements for clothing for special forces personnel necessitates the development of a concept for the design process, which will include steps to improve the protective and ergonomic characteristics of the designed clothing.

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