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COMPUTER IMPLEMENTATION OF THE RECURSION ALGORITHM FOR DETERMINING THE TENSION OF THE TECHNOLOGICAL PROCESS

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Conducted research on the computer implementation of the thread tension determination algorithm on technological equipment using recursion determined the values of thread tension before the zone of fabric and knitwear formation on technological equipment. It has been proven that the amount of thread tension in front of the forming zone is influenced by the number of guides on each specific technological machine, the radius of curvature of the guide, the angle of thread coverage of the guide, the angle of radial coverage of the thread, physical-mechanical and structural characteristics of the thread [1, 6-7].

The values of the angles of coverage by the thread of the guides and the angles of the radial coverage of the thread by the surface of the guide are determined by the geometric parameters and the design of both the thread feeding system on the technological equipment and the design of the guides. Thanks to this, it became possible at the initial stage of designing the technological process to determine the tension of the thread before the formation zone depending on the geometric and structural parameters of the equipment and the physical, mechanical and structural characteristics of the thread [2-5].

The increase in thread tension occurs due to frictional forces in the zone of contact with the guides. The magnitude of the friction forces depends on the material of the thread and the guide, the ratio of their geometric dimensions (the cross-sectional radius of the thread and the radius of curvature of the guide in the contact zone), the actual angle of the thread wrapping around the guide and the angle of radial thread wrapping by the guide surface, the physical-mechanical and structural characteristics of the thread, tension thread in front of the guide. The successive passage of the thread along the guides, from the entry zone to the formation zone of the fabric and knitwear, leads to a stepwise increase in tension. In this case, the output parameter of the tension after the previous guide will be the input parameter for the next guide, which allows you to use recursion when determining the tension before the formation zone.

Experimental studies have confirmed the correctness of the assumptions made when building a model of interaction of the thread with the guide, taking into account its physical, mechanical and structural characteristics, and the possibility of using recursion in the sequential determination of tension in the zones of the technological equipment from the entrance zone to the zone of fabric and knitwear formation. In particular, it was established that the thread tension increases from zone to zone and reaches its maximum before the

forming zone. It is shown that an excessive value of the tension leads to a violation of the technological process and to the breakage of the thread.

Thus, there are reasons to assert the possibility, even at the initial stage of designing the technological process of manufacturing fabric and knitwear, to regulate the thread tension in front of the fabric and knitwear formation zone by adjusting the geometric parameters and design of both the thread feeding system on the technological equipment and specific guides, which will minimize the value of thread tension.

To achieve this goal, it is necessary to solve the following tasks: to develop an algorithm for determining the thread tension on technological equipment; on the basis of a recursive approach, to obtain a mathematical model for determining the tension in front of the formation zone depending on the material of the thread and the guide, the ratio of their geometric dimensions (the cross-sectional radius of the thread and the radius of curvature of the guide in the contact zone), the actual angle of thread coverage of the guide and the angle of radial coverage of the thread by the surface guide, physical-mechanical and structural characteristics of the thread, thread tension in front of the guide; to conduct an experimental study to determine the influence of these factors on the amount of tension in order to assess the correctness of the assumptions made when building a model for the interaction of a thread with a guide.

Список використаних джерел

1. Щербань В.Ю. Базове проектуєчне забезпечення САПР в індустрії моди / В.Ю. Щербань, Ю.Ю. Щербань, О.З. Колиско, Г.В. Мельник, М.І. Шолудько, В.Ю. Калашник. – К.:Освіта України, 2018. – 902 с.
2. Mathematical Models in CAD. Selected sections and examples of application / V. Yu. Scherban, S.M. Krasnitsky, V.G. Rezanov.-К.:KNUTD, 2011. -220р.
3. Щербань В.Ю. Дослідження впливу матеріалу нитки і анізотропії тертя на її натяг і форму осі/ В.Ю.Щербань, В.Ю.Калашник, О.З.Колиско, М.І.Шолудько // Вісник Хмельницького національного університету. Технічні науки. – 2015. – 223(2). - С.25-29.
4. Computer systems design: software and algorithmic components / V.Y. Shcherban, O.Z. Kolisko, G.V. Melnyk, M.I. Sholudko, V.Y. Kalashnik. – К.: Education of Ukraine, 2019. – 902 p.
5. Algorithmic, software and mathematical components of CAD in the fashion industry / V. Yu. Scherban, O.Z. Kolisko, M.I. Sholudko, V. Yu. Kalashnik. – К.: Education of Ukraine, 2017. – 745 p.
6. Shcherban V. Warp yarn tension during fabric formation / V. Shcherban, G. Melnyk, M. Sholudko, V. Kalashnyk // Fibres and Textiles. – 2018. – volume 25. - №2. – PP.97-104.
7. Differential equations of the relative motion of the filament element on the end sections of the coil of the winding drum / I.A. Yakubitskaya, V.V. Chugin, V.Yu. Shcherban // Technology of the textile industry. - 1997. - №6. - P.50-54.