Supervisor's opinion Ing. Brigita KOLČAVOVÁ SIRKOVÁ, Ph.D. to Ph.D. thesis of Zuhaib AHMAD

Dissertation title: Structure and geometry of single and two layer stitched woven fabrics
Student: Zuhaib AHMAD

The method of threads interlacing in woven fabric (single and multi-woven fabric), is described in various articles in various ways, according to the purpose of expression and application, as well as the author's erudition. Weave - its repeat as input parameters for definition of construction parameters is often used as graphically presentation of pattern. It is a simple and illustrative, but not an operative way for description of threads interlacing that would allow the analysis of the relationship between the interlacing of ends and picks and the properties of the resulting woven fabric. More complex ways for description of woven fabric structure are mathematical methods using analytic expression of shape of binding wave in warp and weft threads of woven fabric.

Here, a description is required from which can be determined geometric parameters such as the length of the threads in the binding wave, the height of the binding waves, the interlacing angles, the deformation of the fabric in the longitudinal and transversal directions, etc. These parameters can be used for evaluation of the behaviour of woven fabric in the steady state and in the state of woven fabric formation on weaving machine. The condition for such using, however, is the greatest analytics' in the mathematical sense of the description, i.e. the continuity of the interlacing curves in the higher derivations. Most of the well-known mathematical descriptions do not create it, although the derivation of the interlacing model description is sometimes highly sophisticated.

Using the Fourier series it provides a description of the threads interlacing in whole repeat of weave in the longitudinal and transversal directions of single and multi-woven fabrics. As a result, it is possible to create the description where the functions are continuous, they can be arranged into the mathematical characteristics of the various types of interlacing. It is also possible to operate in the mechanics for analysing of the behaviour of the fabrics, depending on the interlacing manners.

However, it is not enough to apply the Fourier series for the threads interlacing description at the level of the equations as listed in the literature, the sine and cosine components describing the series. It requires a deeper theoretical, computer and experimental study on specific woven fabrics. What shape the amplitude and phase characteristics have and how they expand based on individual types of interlacing of multi-woven stitched construction, their behaviour in terms of properties and application possibilities.

The volume of the presented work shows the necessary extent of the basic aspects of the study. The work includes the analysis and utilization of Fourier series in description of plain weave in single fabric as well as the description of multi-woven fabrics - double layers stitched woven fabric.

The main focus of the thesis is the development of basic relations for the description of a) the theoretical definition of the geometry of the double layers stitched woven fabrics and the creation of the theoretical model for the description of the threads interlacing by using the Fourier series, b) the fabrication of the fabrics and the determination of the characteristics for different position if stitching places, c) the comparison of theoretical models with the experimentally determined complete binding profiles and their numerically obtained Fourier parameters.

From the results it is evident that the Fourier characteristics converge with a certain regularity with the possibility of their application for definition of structure of double layers stitched woven fabric.

The present work offers a wide application in description of woven fabric structure from a point of view of threads interlacing. In my opinion, the idea of this work can be considered to be beneficial and very useful in the future. The student showed great diligence in the preparation of the work and also achieved good formal levels of the submitted work.

I can recommend the work for the defence and based on a successful defence to give degree Ph.D. to a student Zuhaib AHMAD.

Liberec 18.12.2018   Ing. Brigita KOLČAVOVA SIRKOVÁ, Ph.D.