TECHNICKÁ UNIVERZITA V LIBERCI

Nové možnosti rozvoje vzdělávání na Technické univerzitě v Liberci

Specifický cíl A2: Rozvoj v oblasti distanční výuky, online výuky a blended learning

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Staple yarn, multifil - surface structure

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Národní plán obnovy

MINISTERSTVO ŠKOLSTVÍ, MLÁDEŽE A TĚLOVÝCHOVY

Staple yarn, multifil - surface structure

Assignment:

1. Familiarize yourself with the image analysis program NIS Elements.
2. Prepare longitudinal views of the given yarn and multifilament in transmitted and reflected light.
3. Determine the diameter and hairiness of the longitudinal shape (transmitted light images).
4. Find out the diameter, slope of the surface fibres - calculate the twist of the length formation (images in reflected light).

Tools:

- Microscope, macroscope, image analyzer NIS Elements

Continuity:

- Identification of length fabrics - practice from TT1 – KTT

Source of information:

- EXA - KTT lectures
- Internal standard IN 22-102-01/01 Yarn diameter and hairiness
- Internal Standard IN 32-102-01/01 Transverse dimensions of two-ply yarn and diameter of single yarn, Longitudinal views

The principle and procedure of working with image analysis:

In general, image analysis is based on capturing and converting an image into digital form, transforming the image (image editing), identifying (image segmentation) objects or textures (fields), and finally quantifying it into a limited number of data and measurements.

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Diameter and hairiness in transmitted light - NIS Elements version 5.1

A. According to IN 22-102-01/01, take a certain number of images of longitudinal views of the length fabric in transmitted light.
B. Open the images in nd-sequence (here xy sequence).
C. Threshold them in **Binary - Define threshold**, define the yarn as an object (it will be made of pixels 1, i.e. white).
D. Under **Save layer**..., name the binary images and save (e.g. WHOLE YARN). Apply to all images in the sequence.
E. Move the **Binary Layers** to the docking window. Here, find your binary image, select it and go to Duplicate.
F. Rename the duplicated layer (e.g. BODY), you will further modify it with the following recommended operations.

GETTING THE YARN BODY

G. On all images (BODY) perform the morphological operation of linear erosion, "cutting off hairs, but also body parts": Binary - Linear morphology - Erosion...
H. You can increase or decrease the transparency of the overlay image using **CTRL** ↓ or ↑.
I. Since the body part was also cut off, it is necessary to perform back dilation with the same structural element as in step D: **Binary - Linear morphology - Dilation...**
J. I recommend to smooth the resulting body e.g. by morphological operation of opening: **Binary - Opening...**
K. Selecting the feature for measuring the yarn diameter: **Measurement - Object Features...** select "**Min. Feret Diameter**"
L. Yarn diameter measurement: **Measurement - Measure...**
M. Export data: **View - Analysis controls - Automatic measurement results**
N. Export the results to a text file named e.g. "Prumer.txt".

GETTING THE HAIRS

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O. Getting hairs by subtracting the WHOLE YARN and BODY images: **Select the binary layers in the docking window and perform the corresponding binary operation on them.**

P. Creation of "single-pixel" hairs: **Binary - Skeletal morphology - Skeleton...**

Q. **Select the flag for measuring the length of hairs: Measurement - Object features...** select **"Length"**

R. Measurement of the length of the yarn hairs: **Measurement - Measure...**

S. Export data: **View - Analysis controls - Automatic measurement results**

T. Export the results to a text file named e.g. "Chlupy.txt".

Processing of measured data:

1. 1. Calculate the average value of the diameter of yarn D from the data in the text file "Prumer.txt" along with the standard deviation, confidence interval, coefficient of variation. Place the data in Table 1 together with the nominal parameters of the tested yarn.

2. Calculate yarn hairs as a ratio: **H = Total length of hairs (see text file "Hairs.txt")/Height of figure in μm, add the value of H to Table 1.**

Table 1: Sample table for the placement of task results

T [tex]	Z [m^{-1}]	D_1 [μm]	IS-D_1 [μm]	s_{D1} [μm]	CV_{D1} [%]	H [-]	IS-H [-]	S_H [-]	CV_H [%]

T [tex]... nominal fineness of yarn

Z [m^{-1}]... nominal yarn twist

D_1 [μm]... average yarn diameter (Method 01)

IS-D_1 [μm]... confidence interval of the average yarn diameter value

s_{D1} [μm]... standard deviation of yarn diameter

CV_{D1} [%]... coefficient of variation of yarn diameter

H [-]... average yarn hairiness

IS-H [–]... confidence interval for the average yarn hairiness value

SH [-]... standard deviation of yarn hairiness

CVH [%]... coefficient of variation of yarn hairiness

Diameter and inclination of fibres in yarn (multifilament) - reflected light

A. Using a macroscope, take a number of images of the yarn and multifilament in reflected light for the image analysis, REMEMBER TO CALIBRATE THE IMAGES!
B. Open the images in nd-sequence (here xy sequence).
C. To measure the diameter and angle of inclination of the surface fibres of yarn and multifilament, use the interactive measurement: **Measurement - Manual measurement...**
D. Export the measurement data (see procedure in the previous paragraph - task), place it in the following Table 2 and calculate the twist (see subject STR).

Table 2: Sample table for the placement of task results

T [tex]	*Z* [m^{-1}]	D_2 [μm]	IS-D_2 [μm]	β [rad]	Z_v [m^{-1}]

T [tex]... nominal fineness of yarn, multifilament

Z [m^{-1}]... nominal twist of yarn, multifilament

D_2 [μm]... average value of yarn diameter (Method 02)

IS-D_2 [μm]... confidence interval for the average yarn diameter value

β *[rad]*... average value of the surface fibre inclination angle

Z_v *[m^{-1}]*... the calculated twist value

Compare the diameter values from both procedures (microscope - transmitted light x microscope - reflected light)!