The indicators of a softwood qualitative assessment with the use of image analysis systems

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Introduction

Advance methods determining both the quality of raw material and its dimensions were undertaken for a long time and they are still the common research subjects. However, despite that since this day, no technology has been developed in a way allowing to perform these activities in a manner equal or better than human visual assessment. The examples of currently used optimization systems are MiCROTEC, LuxScan, WoodTech, LMI. These methods are working on the basis of the defect's identification, their admissibility in various dimensional and quality functions of prefabricated products. The assessment of the defects images for all the sawn pieces of timber (four-sided scanning system for sawn timber is presented in Fig. 1) allows the identification of the intensity of undesirable features. Studies have shown that knots were the largest groups of identified defects reducing the raw material quality. This conclusion confirmed that the knots constitute up to 75% of all defects affecting the qualitative and dimensional classification of coniferous sawn timber (Duchateau et. all. 2013). The amount of knots and their condition have a major effect on the strength properties of wood such as modulus of elasticity. The known correlation between the modulus of elasticity and the strength allows to determine the technical value of wood from Poland (Krzosek 2009; Roszyk 2016). The aim of the undertaken research was to confirm the hypothesis that the number and the frequency of knots affects the technical parameters of sawn materials.

Figure 1. Projection of a digital image of a sawn wood sample

Results

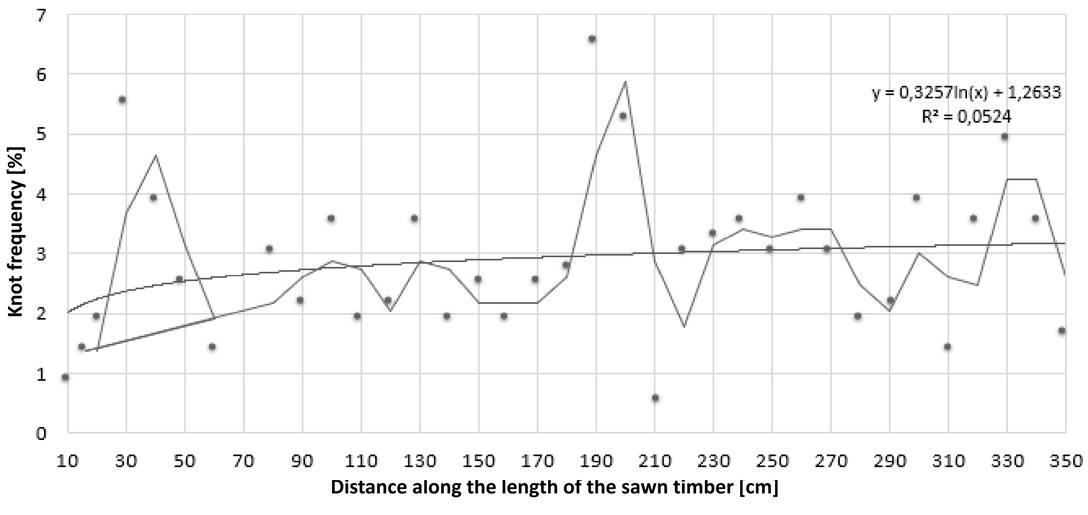

Figure 3. The frequency of knot distribution along the length of pine lumber

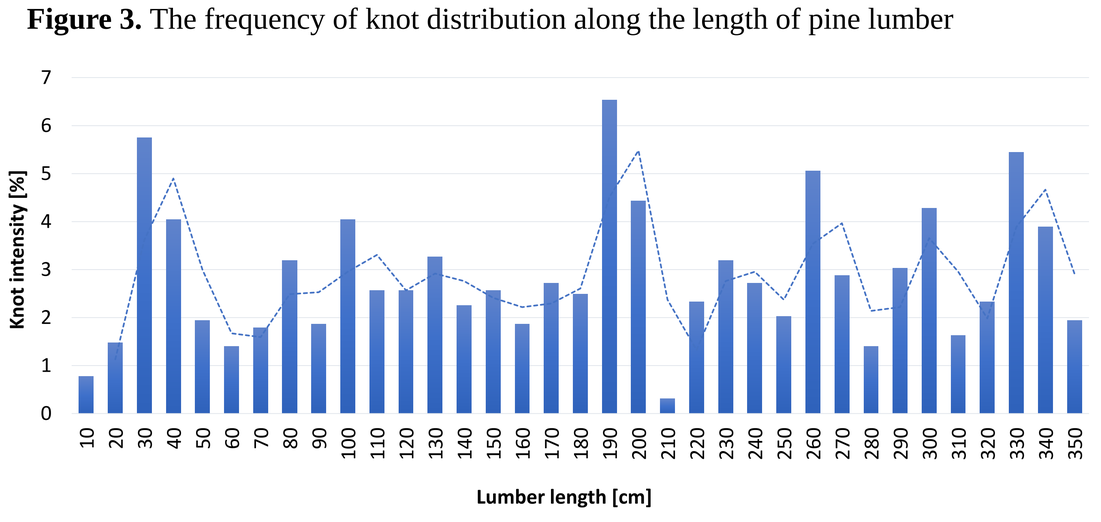

Figure 4. Intensity of the share of knots along the length of pine lumber

Experimental

Test samples were obtained from Southern Poland forest division Olesno. The samples used for testing were characterized by the dimensions of 3500 mm x 138 mm x 40 mm (length x width x thickness). The pieces of timber for the research were obtained from the central part of the butt logs. The anatomy of the lumber was assessed for the presence of knots, which in turn related to its mechanical and physical properties, i.e. modulus of elasticity (MOE) and apparent density at a moisture content of 12%, as it is shown in Table 1. The MOE was determined according to EN 408:2010+A1 (2012) for the bending test.

Table 1. Properties of lumber used to test

No.	MOE (kN/mm²)	ρ (kg/m³)	No.	MOE (kN/mm²)	ρ (kg/m³)	No.	MOE (kN/mm²)	ρ (kg/m³)
1	10,00	531	10	12,66	552	19	10,54	645
2	13,27	588	11	11,43	542	20	16,15	685
3	10,47	631	12	10,31	526	21	9,77	561
4	15,19	658	13	7,25	481	22	9,56	598
5	10,28	618	14	15,52	615	23	11,22	616
6	11,31	497	15	12,02	531	24	9,59	507
7	13,16	583	16	11,16	536	25	14,53	655
8	13,11	546	17	13,80	686	26	9,02	552
9	7,87	469	18	12,48	644	27	10,79	586

This study was based on the assessment of generated sawn wood segments, comprising a 10 mm × 100 mm knot zone. The following parameters were evaluated:

- Lengthwise frequency of knots in the sawn wood as the number of lengthwise clusters of defects,
- Crosswise incidence of knots, referred to the number of defects in the measured sections Fig. 2.

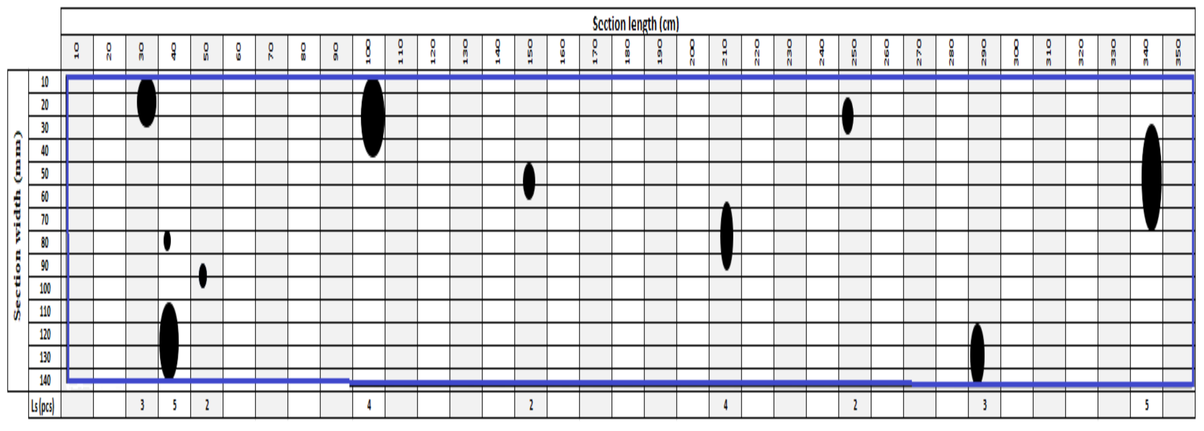

Figure 2. Determination of knottiness frequency and the principles of separation of knot incidence zones; Ls (pcs) denotes the number of sections with knots

Conclusions

- The butt-end lumber shows an even distribution in the knots frequency along its length, which is not correlated with the location along the length of the logs.
- . The results indicated that there was no correlation between the knot distribution and the length of the sawn wood samples. Furthermore, a considerably increased incidence of knots, with peaks occurring at approximately 150 cm intervals was observed.
- The intensity of knots presence is variable, however, they occur with a repeated growth amplitude every 40-70 cm, which corresponds to whorls occurring in pine stands (knot rings in annual increments).

References

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EN 408:2010+A1:2012 Timber structures. Structural timber and glued laminated timber. Determination of some physical and mechanical properties

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