



RESULTS OF EXPERIMENTS WITH SAW BELT CUTTING USING THE SPECIAL GEOMETRY OF TEETH

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Abstract

The paper presents results of experiments obtained at cutting by a saw belt with the combined geometry of teeth. Three types of toothing were designed. In each type of toothing, the theoretical methodology was determined of the calculation of energy elements. The principle of theoretical analyses creates the content of another paper at this conference. The methodology of measurements of energy elements and measuring equipment are the same as in experiments with the knife-shaped geometry of teeth, see, eg [2], [3]. The experiments demonstrated compatibility with a theoretical model.

Key words: saw belt, tooth geometry, energy elements of cutting

INTRODUCTION

At present, improving the parameters of sawmill technologies is aimed, among others, at the field of partial modifications of the geometry of teeth with an endeavour to achieve higher technological parameters.

The aim of the paper is to present possibilities of changes in the geometry of teeth in saw belts and their energy requirements at cutting. The basic idea consists in using properties of rough wood particularly its potential of plastic and elastic deformation. Under these conditions, a special geometry is designed of the cutting tool teeth. The content of another paper consists in testing the theoretical model by an experiment.

SPECIAL GEOMETRY OF A CUTTING TOOL

At the implementation of our experiment, three types of a cutting tool were selected. In the first variant, groups at three teeth were always involved in the whole process of sawing. The first tooth is not set carrying out cutting the material. The second and the third tooth are set each to opposite side carrying out "smoothing" the surface inside the saw kerf. They do not share in cutting the material, see Fig. 1.

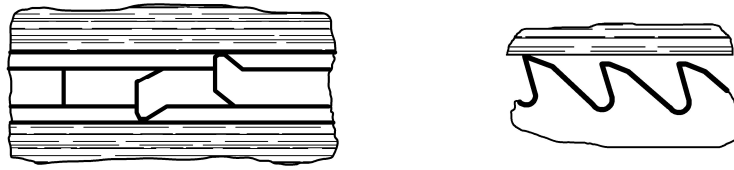


Fig. 1 The scheme of a cutting tool - Variant 1

In the second variant, the cutting tool is designed in such a way all teeth to cut and, at the same time, to carry out smoothing the material. All teeth are set. To simplify theoretical calculations, it is possible to suppose that each of the teeth cuts out just one half of the material from the saw kerf.

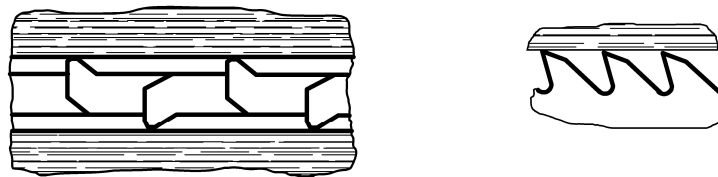


Fig. 2 The scheme of a cutting tool - Variant 2

The third variant is the combination of the first and the second variant. In the whole process of sawing, groups at three teeth are included again. The first tooth is not set carrying out cutting the material. The second and the third tooth are set each on the opposite side carrying out cutting and smoothing the area inside the saw kerf, see Fig. 3.

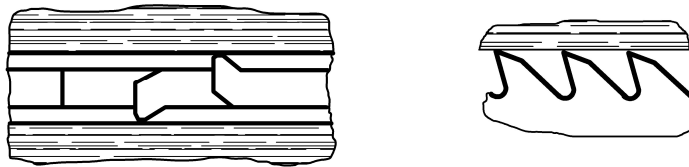


Fig. 3 The scheme of a cutting tool - Variant 3

METHODS OF MEASUREMENT

Methodology and systems of measurement are identical and tested during long-term experiments, which were presented, eg in [2], [3].

The basis of a measuring stand consists of a mobile band saw Husqvarna SMB 70. For this experiment, willow was selected, moisture 60%, sample diameter 50 mm, sample length 2 m. Tools were adapted from a standard saw belt 1 mm thick, tooth pitch 25 mm, cutting speed 35 ms^{-1} .

EXPERIMENT

At the experiments, particular types of designed tools were gradually tested. Results are presented in diagrams. At the same time, the theoretical value is given of the cutting power, which was calculated according to a modified analytical method. For the first variant of the tool, results are given in Fig. 1, for the second variant of the tool in Fig. 2 and the third variant is presented in Fig. 3.

Results obtained show that the most stable results occur in Variant 3. Also at this type of tothing, the highest coincidence occurs of theoretical conditions with the experiment results.

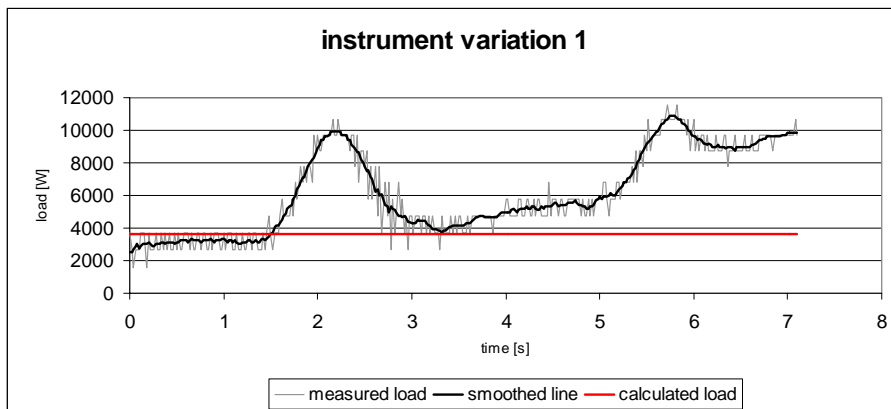


Fig. 1 Tool – Variant 1

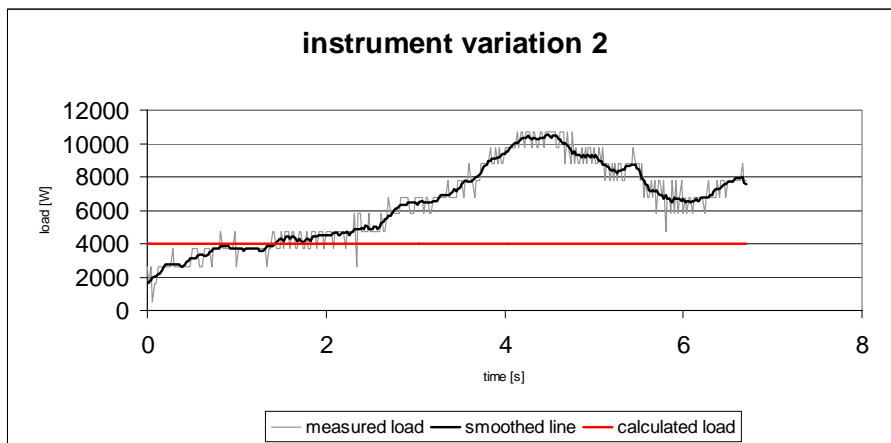


Fig. 2 Tool – Variant 2

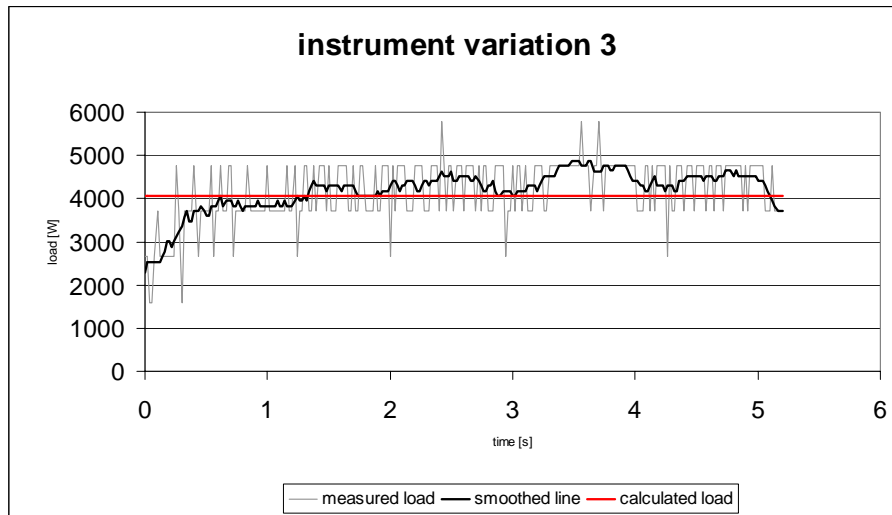
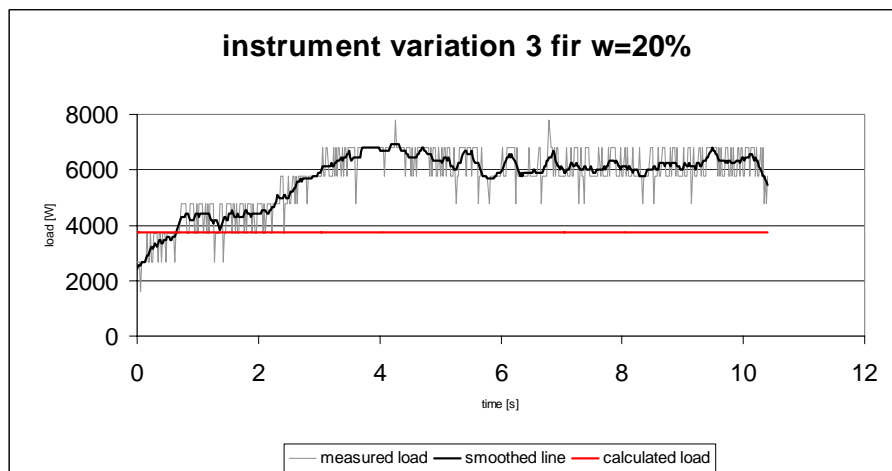


Fig. 3 Tool – Variant 3

In the first stage of experiments, an extremely soft tree species was selected, namely newly felled willow by reason of testing the functionality of the measuring stand during sawing by the unconventional tooth system. In the next stage, a tool according to Variant 3 was tested (Fig. 3) during sawing a standard tree species. For the purpose of this experiment, silver fir was selected, wood moisture 20%, diameter 50 mm, log length 3 m. Other parameters of the cutting process were identical with previous ones. Results are evident from Fig. 4.



CONCLUSION

During experiments, proposed variants of the combined toothing of a saw belt demonstrated the potential of cutting. Present experiments, however, showed that Variant 3 represented the highest stability during the cutting process. A theoretical model of the

calculation of energy elements also shows the highest congruence just in Variant 3. In the next stages of research, attention will be paid to monitoring other elements of sawing, eg the saw kerf roughness and if strengthening the saw kerf occurs according to theoretical conditions.

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