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 Research Article

Axial Deviation Of Saws For Round And Hexagonal Shafts

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ABSTRACT

This study investigates the phenomenon of axial deviation in saw blades used for round and hexagonal shafts, focusing on its causes, dynamics, and operational consequences. Although saw discs are mechanically resilient, they often undergo geometric deformation during operation, leading to unbalanced mass distribution across their axes of symmetry. Axial deviation, characterised by blade deflection in the horizontal or vertical plane, results in dynamic imbalance, vibration, and contact between saw discs and grates. These distortions accelerate wear of bearings, reduce the lifespan of saws and grates, increase energy consumption, and cause fibre and seed damage during processing. The research highlights the generation of centrifugal unbalanced forces of varying vectors, which induce oscillations of the saw cylinder and disrupt stable fibre engagement. The findings emphasise the importance of geometric precision and shaft design in improving saw stability, performance, and overall operational reliability.

KEYWORDS

Axial deviation; saw blade geometry; dynamic imbalance; vibration; round and hexagonal shafts; centrifugal force; fibre damage; mechanical reliability.

INTRODUCTION

Despite their resistance to mechanical damage, saw discs frequently change their geometric shape.

When the geometry of the saw blade is distorted, it becomes unbalanced on all axes of symmetry.

Several types of deviation are known: radial, axial, and combined (radial and axial), and in the saw blade, axial deviation occurs mainly.

The axial deflection of a saw blade is the deflection of the blade in a horizontal (or vertical) plane.

With axial deviation of the saw disc, the masses are not evenly distributed in the planes, which leads to imbalance of the saw cylinder, vibrations, contact of the saw discs with the grates, etc. As a result, the service life of saws and grates is reduced, fiber and seed damage increases, electricity consumption increases, etc.

METHODS

The inclined geometry of the saw blade causes the formation of centrifugal unbalanced forces of

various vectors, leading to the vibration of the saw cylinder. This, in turn, leads to the following consequences:

- faster wear of supports (bearings). With an increase in such loads, there is a risk of sharp failures;
- vibration of the saw cylinder is transmitted to the working chamber and the gin, which leads to discomfort in operation;
- saw discs do not fail uniformly due to uneven loading (the discs between the saw cylinders fail faster);
- unstable engagement of saw teeth with the raw material roller.

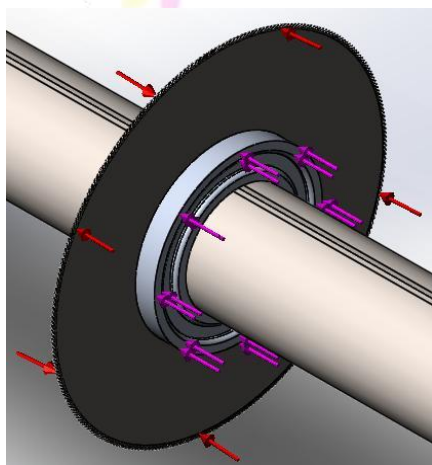


Figure 1. Force and pressure acting on the saw blade for a circular shaft

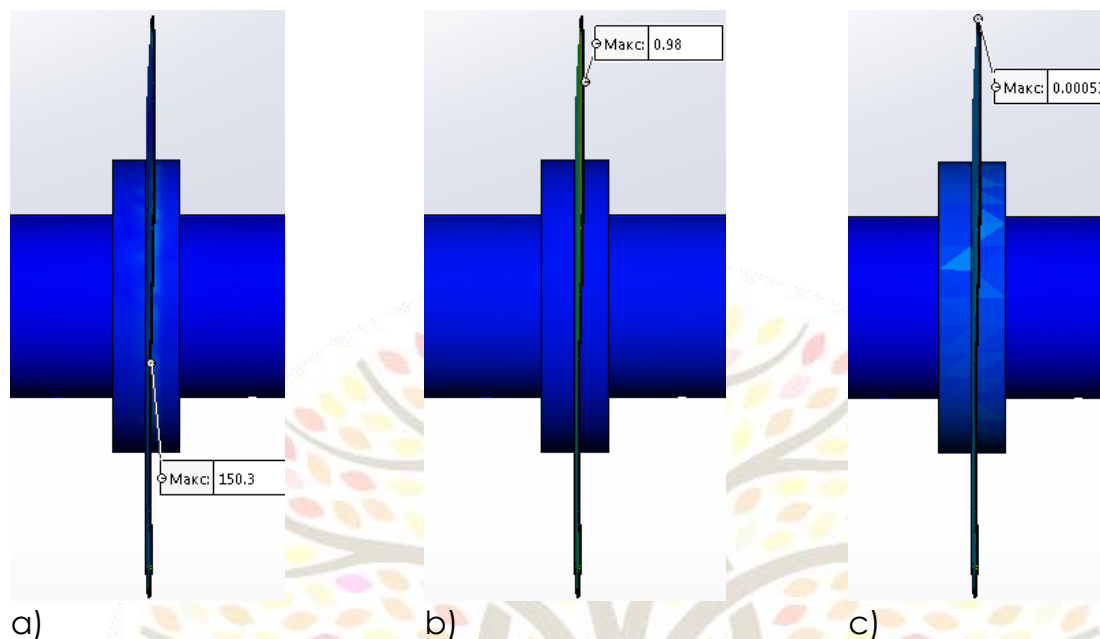
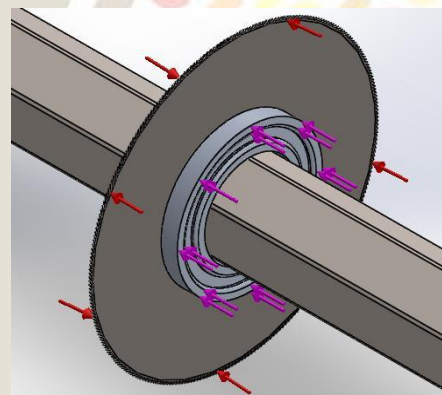


Figure 2. Maximum stress (a), axial deviation (b) and deformation (c) of the saw blade for a circular shaft

Figure 3. Force and pressure acting on the saw blade for a hexagonal shaft



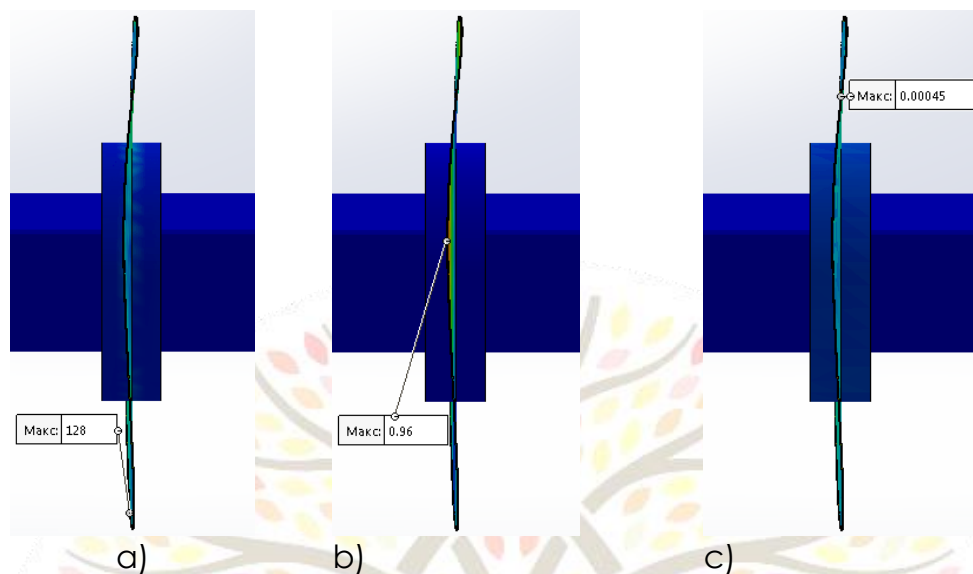


Figure 4. Maximum stress (a), axial deflection (b) and deformation (c) of the saw blade for a hexagonal shaft

To study this problem, we use the SolidWorks Simulation package. We assume that the greatest axial deviation occurs in saw discs located in the middle of the saw cylinder, and we will conduct research for this case.

RESULTS AND DISCUSSION

The axial clamping force of the saw and gaskets is equal to. We assume the pressure on the saw discs from the raw material roller (Fig. 1). [1, 2]

As can be seen from the diagrams of Fig. 2, with an increase in the density of the raw roller, the pressure arising from it leads to axial deviation of the saw disc, and its maximum value is 0.98 mm. This leads to negative consequences, interfering with the passage of saw discs between the grate bars.

In the same order, under the same conditions, we perform calculations for the saw discs for the

hexagonal shaft (Fig. 3). The diagrams in Figure 3.29 show the mechanical characteristics of saw discs for the hexagonal shaft.

As can be seen from the diagrams (Fig.4), the maximum value of the axial deviation of the saw disc for the hexagonal shaft is 0.96 mm. This is significantly smaller than the saw disc for the round shaft.

CONCLUSIONS

Based on the foregoing, it can be concluded that the use of a hexagonal shaft and corresponding saws for the saw cylinder of a saw gin is advisable due to a reduction in axial deviation.

When the density of the raw roller increases, the pressure generated from it leads to the displacement of the saw disc from the plane, and its maximum value is 0.98 mm, and for the proposed

hexagonal shaft, the maximum value of the saw disc displacement from the plane is 0.96 mm.

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