BENDING STRESS ANALISYS IN WOOD CHIPBOARD EMBED ON THREE SIDE AND FREE ON FOUR UNDER NORMAL COMPOSITION ACTION OF CHIPPING FORCES AND SOLE WEIGHT

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Abstract
This work paper is theoretical analyzes in case of the bending stress and characteristically section moments of wood chipboard, determine by numerical methods, such as finite difference method. In this calculus we establish in real mode the dangerous zone from cross-cut section where action the disturbing forces and where cracks appear.

Key words: finite difference method, cross-cut bending efforts, disturbance forces, partial differential equation.

INTRODUCTION

The theoretical analysis of cross-cut bending efforts of plane wood chipboard was making by using numerical method, finite difference method.

In various cases of plane chipboards they have a real practical interest. They can’t be put in evidence the analytic solution of difference equation by directly integration because of shape profile, loaded module with distributed or concentrated disturbance forces and because of shape condition (G., Cheregi, Teodora Anca Şandor, 2006).

Using the numerical or variations method in this situation to obtain approximately solution is presented a major practical interest result in solution with satisfactorily precision level (Posea N., 1991).

The used finite elements method for efforts stress determination from wood plane chipboard sections with finite difference method is a part of numerical methods frame.

To determine the finite difference method solution we must determined the numerical values of bending stress studies domain points and limits (Polidor Bratu, 1995).

MATERIALS AND METHODS

The theoretical analysis on wood chipboard was making to case of cut with a circular saw. The circular saw using to cut the wood chipboard has the next parameters: diameter – 300 mm, teeth – 96.

The dimensions and weight of analyzed wood chipboard is: L x l x h = 2 x 1 x 0.018 m, m = 27 kg and $G_{WOOD} = m_p \cdot g = 264.6$ N ≅ 265 N.

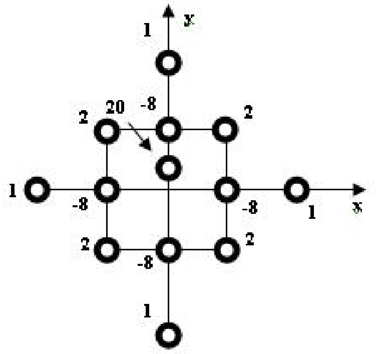
We must consider the action of normal component chipping force and the action of sole weight.

The wood chipboard was split by dint of parallel lines cross grating with axes x and y. The obtained cross grating with next steps is: $h_x = h_y = \frac{a}{4}$

For considered chipboard with next steps of cross grating in equal relation with x and y the partial differential equation of out-of shape median chipboard surface:

$$\frac{\partial^4 w}{\partial x^4} + 2\frac{\partial^4 w}{\partial x^2 \partial y^2} + \frac{\partial^4 w}{\partial y^4} = \frac{q(x,y)}{D}$$

We wrote in certain point m, n of cross grating in finite difference with bi-harmonic operator help.



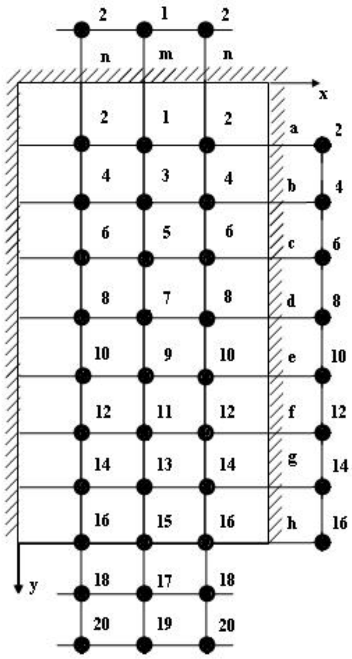


Fig. 1 The lines and nods cross grating.

We must wrote the partial differential equation in each point of cross grating where the movement w_{mn} is unknown and we obtain a system with 16 algebraically equation.

The equation was written in points from the shape neighborhood. In this equation the w movement from exterior shape points has make representations and we obtain a bigger number of equation.

When we wrote the shape condition in finite difference, we obtain supplementary equation.

Using the program SISELIM 1 we determined the movement values from cross grating nodes.

For determination of bending stress of cross grating nodes the second order derivate of movement in relation with x and y axe is in relation with the chipboard.

The second order derivate has the finite difference derivation operator:

$$\left(\frac{d^2 w}{\partial x^2}\right)_i = \frac{w_{i+1} - 2w_i + w_{i-1}}{h^2}$$

The adequate operating molecule of this operator is:

$$\frac{d^2}{dx^2} = \frac{1}{h^2}$$

Using the difference relation from bending moments effort and nodes movement we determined the characteristically reaction of bending moments.

$$(M_x)_i^G = -D\left(\frac{\partial^2 w}{\partial x^2} + \mu \frac{\partial^2 w}{\partial y^2}\right) = -D\left(\frac{\partial^2 w}{\partial x^2}\right)$$

The position points on the chipboard shape have the bending moment efforts in relation with x ax can't be null. The movement in point on the chipboard with fixed ends shape is null.

On the chipboard with fixed ends the values of bending moment efforts from cross grating position nodes is negative. In this case we have a stand up movement on the fixed ends border of wood chipboard.

For the bending moment calculus in relation with y ax we calculate the second derivate of movements from cross grating nodes using the same finite difference derivation operator.

$$\left(\frac{\partial^2 w}{\partial y^2}\right)_j = \frac{w_{j+1} - 2w_j + w_{j-1}}{h^2}$$

In the second level of this calculus we considered the loaded chipboard with chipping normal component force.

With the introduction of free term expression in matrix system we can obtain the arrows values from cross grating nodes by using the SISELIM programs. We determined the second order derivate of movement produce by chipping normal component force in relation with x ax.

The second order derivate of movement in relation with y ax produce by chipping normal component force and the corresponding bending movement is:

$$(M_x)_i = (M_x)_i^G + (M_x)_i^{F_n}$$

The values of cross-cut section from the chipboard characteristically section is result from self weight action and chipping normal component force.

We obtain the applied superposition effects principle.

RESULTS AND DISCUSSION

The next results gives us a really radiography about the most dangerous applicant section from the wood chipboard.

The movement diagram from true specific weight action.

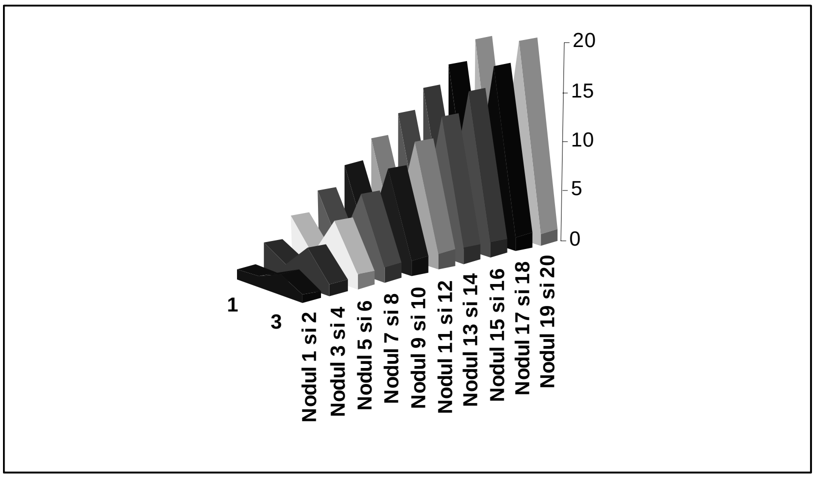


Fig. 1. The movement w diagram from normal component of chipping force action.

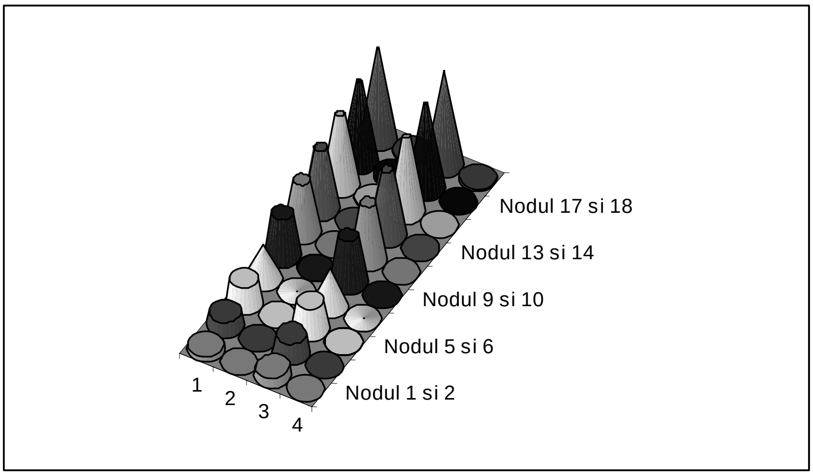


Fig. 2. The bending moments diagrams (M_n) in relation with x axes obtain by using the superposition effects principle.

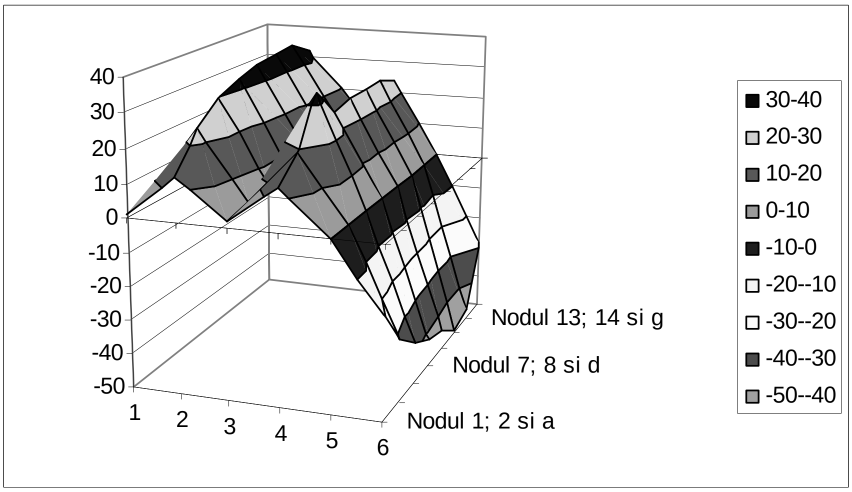


Fig. 3. The bending moments diagrams (M_n) in relation with y axes obtain by using the superposition effects principle.

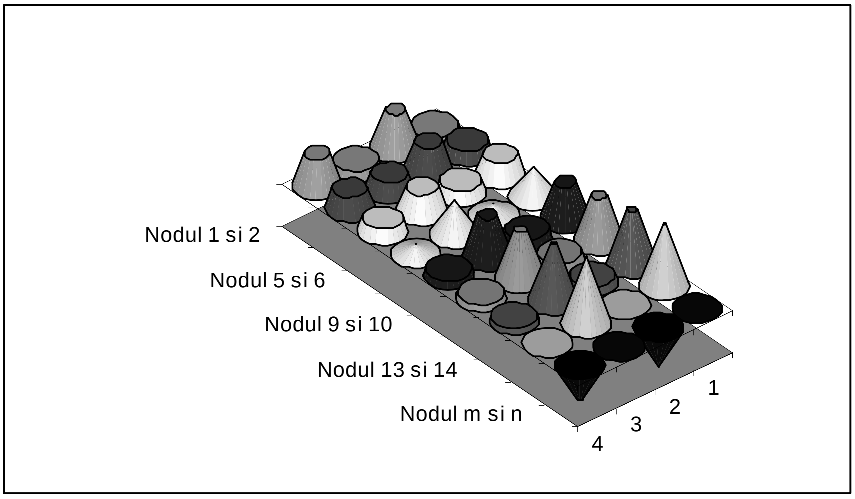


Fig. 4 The bending moments diagram in 3D

CONCLUSIONS

The make analysis on wood chipboard gives us a complex image about effort and bending stress from cross-cut section. If we use any kind of analytics, numerical or variations method, we can see the most dangerous applicant section from the chipboard.

The produce efforts by chipping force cross-cut component are smaller then normal component produce effort. The chipboard resistance calculus is insignificant.

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