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BEAM STRUCTURES STATIC AND DYNAMIC ANALYSIS WITH FINITE ELEMENT METHOD IN ALGOR PROGRAM

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ABSTRACT:
The paper is a study about the modern calculation and analysis beam structures possibilities with finite element method in *Algor* program. The authors make a static analysis to beam structure, respectively they determinate the natural frequencies (modal analysis). The method presented in this paper assumes structure geometric modeling, defining the constraints and loads, make analyze, respectively generate and comment the results.

KEYWORDS:
Finite element analysis, beam structure, axial stress, deformations

1. INTRODUCTION

Algor program include design, analyze and simulate tools who allow engineers to make virtual test and to predict new and existing designs behavior. These tests are very useful for the engineers because allows them to increase the product market speed and improve the security and price.

It's a lot of simulation possibilities: static analysis, dynamic analysis, mechanical event simulation, thermal transfer analysis, fluid flow analysis, electrostatic analysis, and others.

All these analysis and simulations allow utilizing linear, nonlinear and composite materials for analyzed components.

The steps to follow in finite element analysis are:

- generate mesh model
- add loads
- defining the boundary conditions who prevent model displacement
- defining elements properties
- stiffness matrix assembly
- solve the linear algebraic system
- stress calculation
- view the results

2. BEAM STRUCTURES STATIC ANALYSIS

The steps in static analysis with *Algor* program are: modeling the beam structure, add the boundary conditions and loads, stress, deformation, factor of safety calculations, with one of the theory (von Misses, Tresca). The studied beam structure is presented in figure 1. (F_1 = 280kN; F_2 = 210kN; F_3 = 280kN; F_4= 360kN)

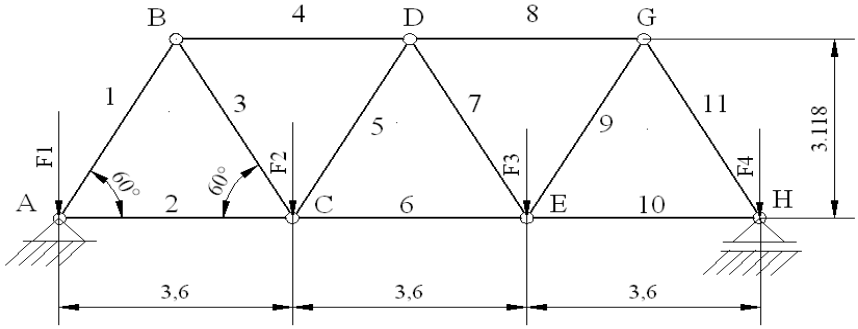
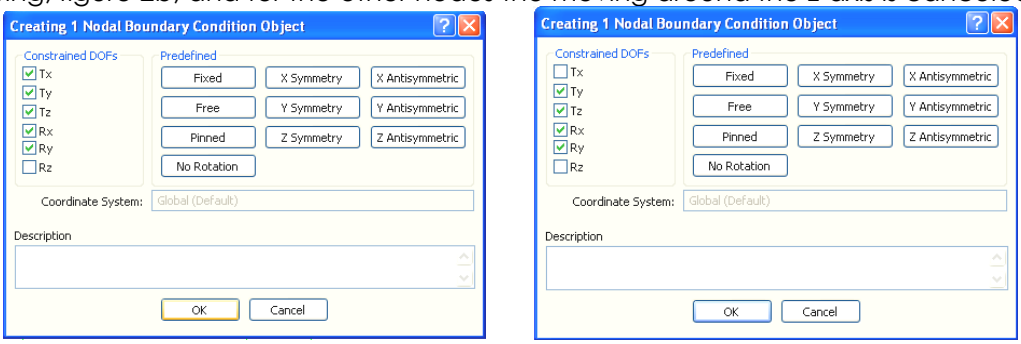


FIGURE 1. BEAM STRUCTURE

Beam structure static analysis follows the next steps:

- beam structure geometric modeling
- element type – *Truss*
- element definition
- material definition
- define the nodal boundary conditions: node A – joint, figure 2a, node H – movable bearing, figure 2b, and for the other nodes the moving around the Z axis is canceled.



a b

FIGURE 2. NODAL BOUNDARY CONDITION

- loads definition – nodal force and net weight
- perform analysis
- generate the results report
- viewing and interpretation the results

In the following figures are presented some of the obtaining results:

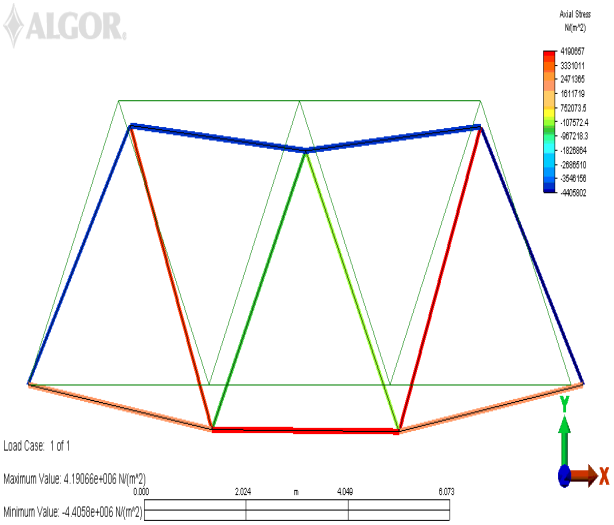


FIGURE 3. AXIAL STRESS IN BEAMS STRUCTURE

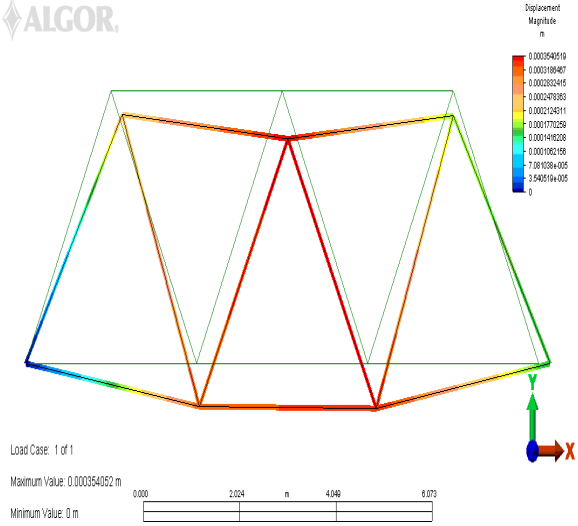


FIGURE 4. Displacement magnitude of the structure

3. BEAM STRUCTURE MODAL ANALYSIS

Modal analysis in *Algor* made with „*Natural Frequency (Modal)*" analysis type determines the natural frequencies for the structure. For modal analysis the authors define a new analyze scenario (design scenario 2) with the same characteristics (geometry, loads, constraints) that are already define in static analysis. In figure 5 are presented the 5 natural modes obtained in analysis.

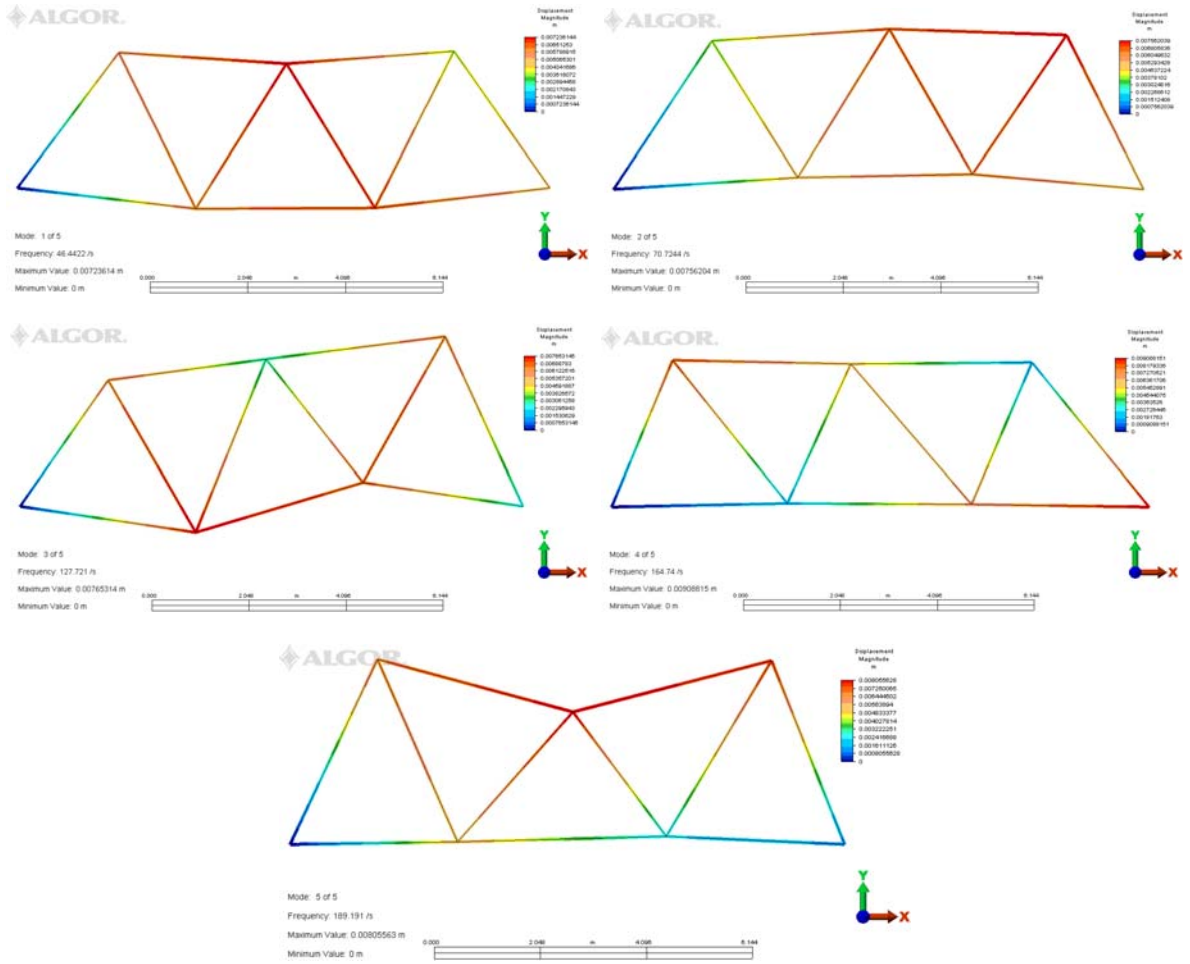


FIGURE 5. The 5 natural modes

4. CONCLUSIONS

In general, the structures behavior analysis and particular the beam structures are the benefits of a lot of programs who utilize finite element method.

Utilizing the computed aided design programs and finite element method analysis is very easy to calculate structure deformations, stresses and displacements in different sections and characteristic points of the structure, as well as size determination and structural elements construction.

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