THE OPTIMIZATION OF THE DESIGN STRENGTH CHARACTERISTICS OF THE FRAME OF THE TRACTOR

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Abstract

At present there are a many constructions of the carrier systems of motor transport means, bodies with the systems of communications in the form of rigid triangles executed in the form. This makes it possible to assume that the technical solution has high efficiency and correctly it can be examined in application to the tractors. An increase in the hardness, strength and longevity of frame due to an increase in the dimensions of the profile used or improvement of technology and design of the welded connections, which decrease the stress concentration in the region of the welds, can prove to be not the most rational solution from the point of view of labor expense and material consumption. More preferable in this respect the frame, made in the form of three-dimensional truss in lower part of which is fastened running apparatus, and inside are located engine, transmission, panels of skin of cowling and cab, control station. But since farm in "pure" form because of the impossibility to have struts on the front is hardly possible, although the inclined cross connection in the aperture of front glass of cab and does not contradict the requirements of field of view, has sense to speak about skeleton type frame, where only the sidewalls and the top of body to a greater or lesser extent answer the classical determination of farm.

Keywords: *tractor, the carrier system, strength characteristics*

The application of contemporary calculation methods with the design of units and aggregates in the tractor construction they today become necessary for creating the competitive product. Machine design makes possible in the development stage to produce sufficiently deep optimization without resorting to for the production of prototypes. As shows practice [1], errors in the results of obtained with the aid of CAE (Computer-aided engineering) in the majority the case does not exceed 5%. An increase in the operating characteristics of units and aggregates, and so a reduction in the prime cost they have the highest priority among the tasks, solved by tractor constructors.

In the represented work on the basis of the created WITH FEM (finite of element of method - method of final elements) model, was produced the number of the studies of the influence of the design parameters of the carriers of frame on the performance properties of tractor. Studies were conducted with the use of calculated complexes ANSYS, Solid Works, Win Machine Structure 3D

The concept of a study consists in the idea of the frame of the agricultural tractor VT -150 of the production joint stock company "VgTZ" in the form of the three-dimensional body with the developed diagonal stays, to lower part of which running apparatus is attached, and power plant is placed in the resultant internal volume.

The represented solution makes it possible to a considerable degree homogenize general stresses in the construction with decrease in the mass and an increase in the hardness of construction. In conjunction with decrease in the mass to 30- 40%, the results described above give grounds to assume that the results not maximum and exist significant potential for the optimization.

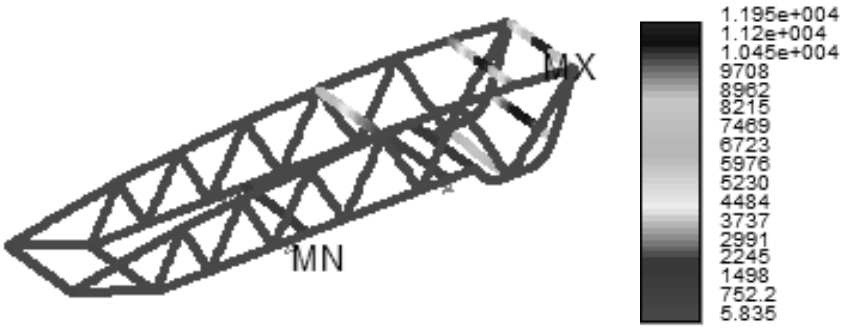

Fig. 1. Safety factor on the fluidity

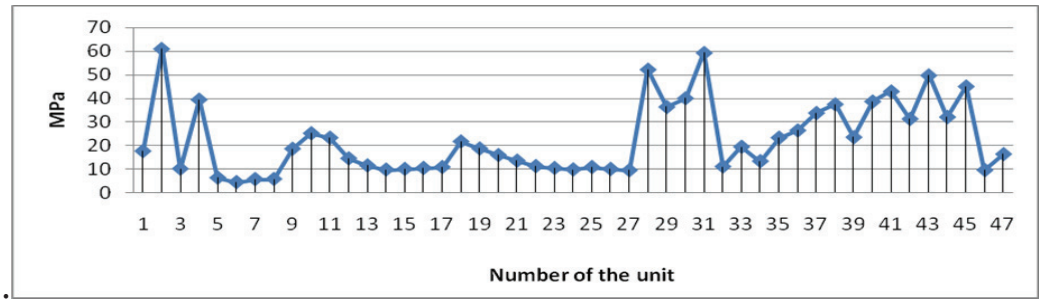

Fig. 2. Equivalent stresses in the units of the longer on type frame

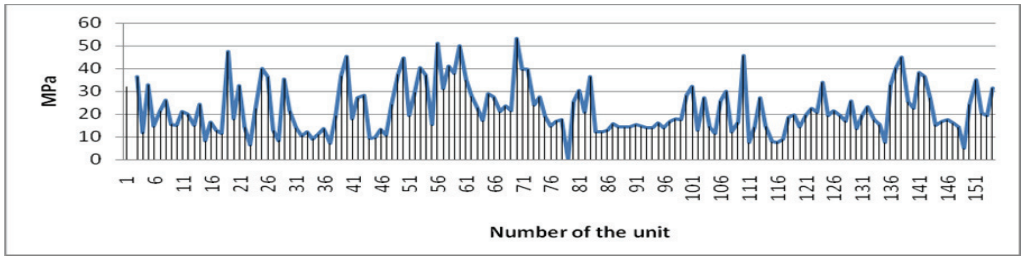

Fig. 3. Equivalent stresses in the units of the skeleton frame

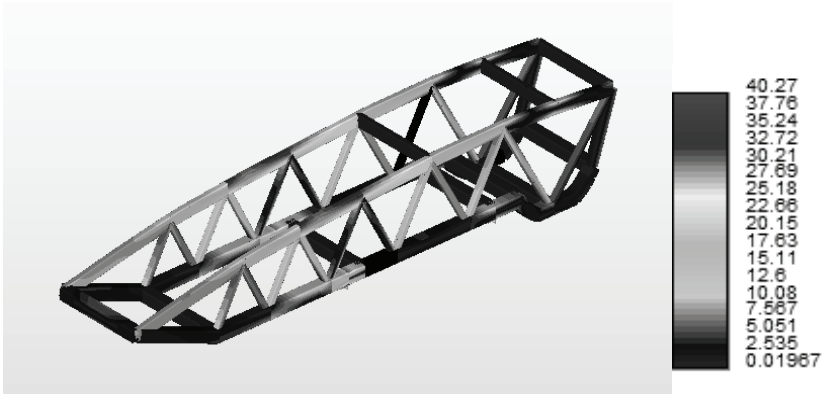

Fig. 4. Diagram of the general stresses (MPa)

Taking into account the fact that carrier system of any cargo vehicle it is basic unit and its period of service it cannot be less than the period of the service of machine itself as a whole. The construction of the frame of tractor VT -150 does not in certain cases answer this definition, in the sufficiently critical sections of frame the fatigue cracks are formed.

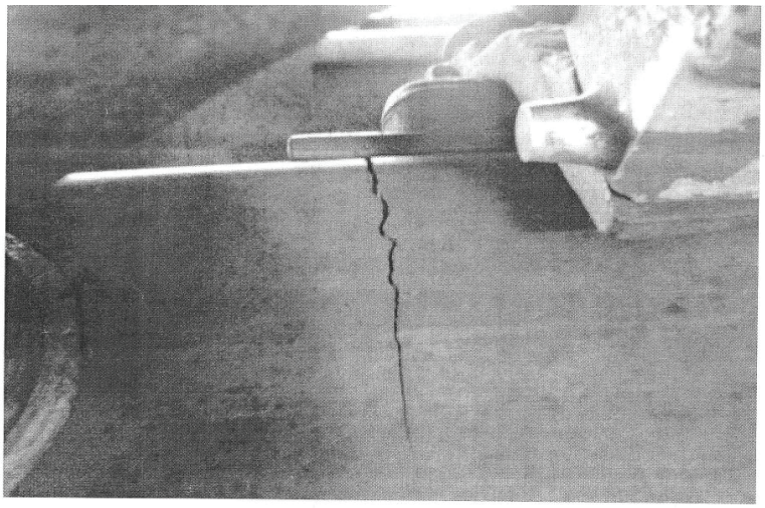

Fig. 5. Photograph of the fatigue crack of longeron type frame

To the advantages of skeleton frame also can be attributed the considerable expansion of possibilities for the design of the upper construction of the tractor of important for creating the original aesthetics- visual means, which makes it possible to increase the competitive ability of the machine.

Tab. 1. The natural frequencies of the skeleton frame

No	Frequency. rad/sec	Frequency. Hz
1	196.8	31.3
2	378.7	60.3
3	381.1	60.6
4	475.1	75.6
5	544.7	86.7
6	545.8	86.9
7	613.9	97.7
8	650.9	103.6
9	814.3	129.6
10	918.5	146.2
11	935.5	148.9
12	1022.2	162.7
13	1053.0	167.6
14	1117.5	177.9
15	1162.5	185.0
16	1434.8	228.4

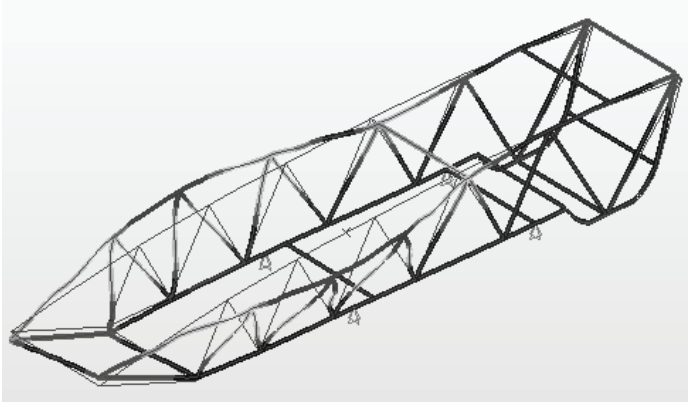

Fig. 6. Natural fluctuations of construction at the frequency 86 Hz

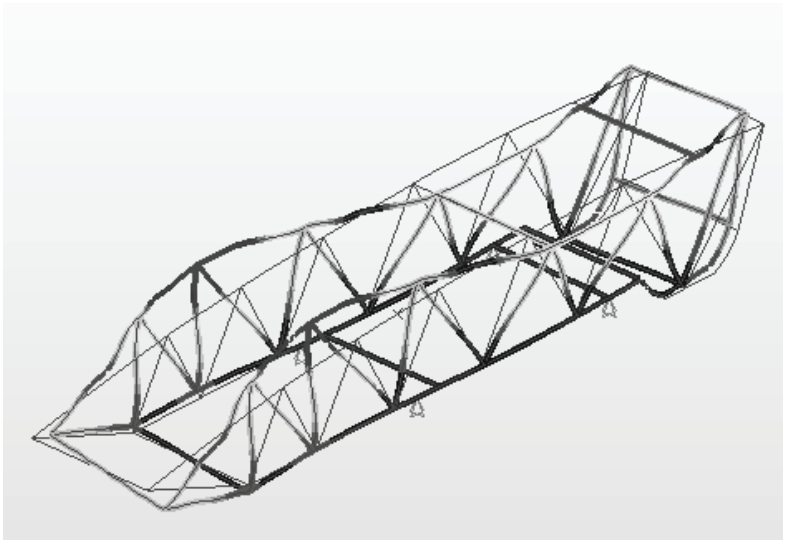

Fig. 7. Natural fluctuations of construction at the frequency 103 Hz

To the data of construction is given the claim for the useful model of № 2010134791/11 (RU), and is also prepared scale (1:4) the physical model of frame for conducting the number of the full-scale tests.

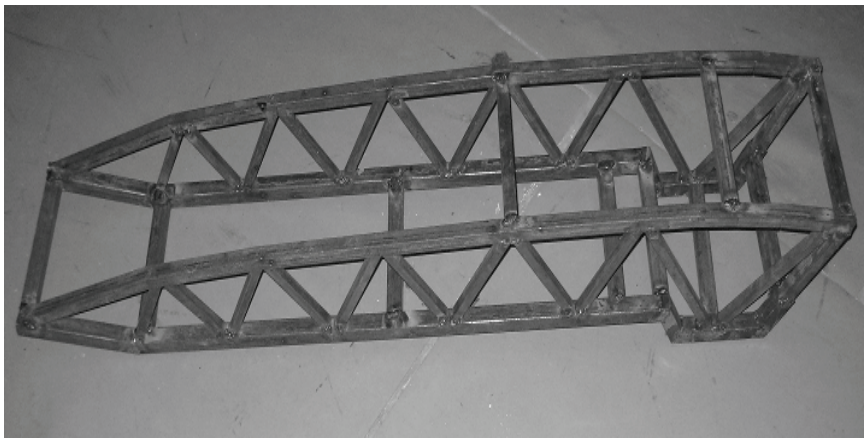

Fig. 8. The physical model of skeleton frame

On the basis of the obtained results, described it is in this work correct to carry the given construction into the discharge of the promising technical solutions with the high technological and economic potential.

References

[1] Agapov, V.P., *Methods of final elements in the statics. to the dynamics of the stability of the three-dimensional thin-walled reinforced constructions*, M.: Publishing house [ASV], 2000.
[2] ANSYS 5.6.1, *Theory Reference*, ANSYS, Inc., 2000.