DEFORMATION OF THE TURBOGENERATOR ROTOR TGV-200 FROM THE EFFECT OF CENTRIFUGAL FORCES

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Introduction. Turbogenerators (TG) that are being used in thermal and nuclear power plants, play an important role in the process of generating electricity. In abnormal operating modes there are increased values of mechanical stresses affect on a rotor of TG that can create cracks [1]. Typically, the rotor of TG is investigated for the presence of cracks in the process of planned-preventive repairs, which requires a downtime of electric stations blocks, which is accompanied by significant losses. Therefore, the problem of research of mechanical stresses and deformations in the rotor of TG with the use of field methods of mathematical modeling is actual. This allows us to estimate areas in the TG rotor, which are the most stressed and in which rotor cracks can occur due to the effect of alternating periodic efforts.

The goal of the work. The goal of the article is to investigate with methods of mathematical modeling the features of dispensation of steel deformation in the TG rotor.

Material and results of the research. To study the mechanical stresses a turbogenerator TGV-200 capacity of 200 MW with water-hydrogen cooling was chosen, which has the following parameters: the diameter of the rotor barrel 1075 mm, the length of the rotor barrel 5100 mm, the number of teeth on the rotor, $Z_2 = 36$, the rotor speed, n = 3000 rpm, the material of the rotor winding - copper.

In this article, the deformations of the rotor of TG are studied, which are formed as a result of the action of centrifugal forces from rotor rotation. The force of gravity acting on the rotor is not investigated.

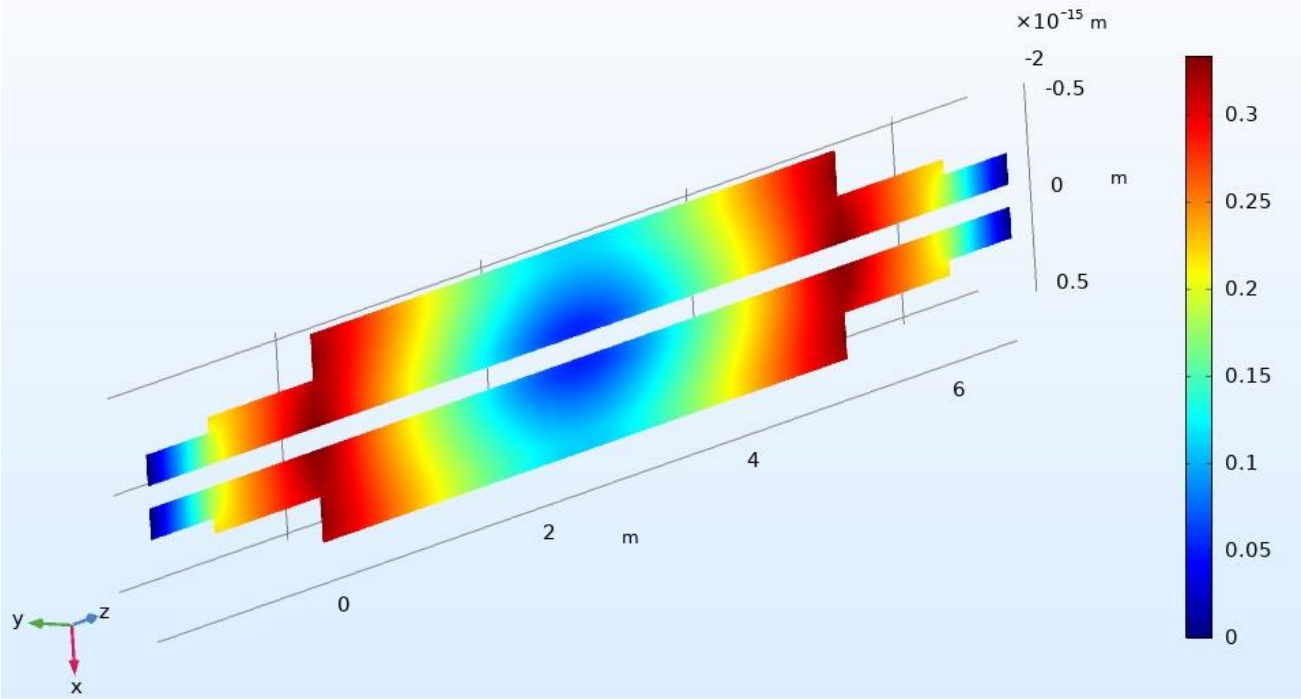
According to the results of mathematical studies of deformations in the steel of the TG rotor, the following results were obtained.

In pic. 1 shows the dispensations of the steel deformation value of the TG rotor in the longitudinal plane of the TG rotor from the action of centrifugal forces. In pic. 2 shows the dispensation of the steel deformation value of the TG rotor along a line located 20 mm from the central hole of the rotor and in the longitudinal plane of the rotor of TG along the axis d. From the analysis of the deformation dispensations of the rotor of TG, one can made the following conclusions.

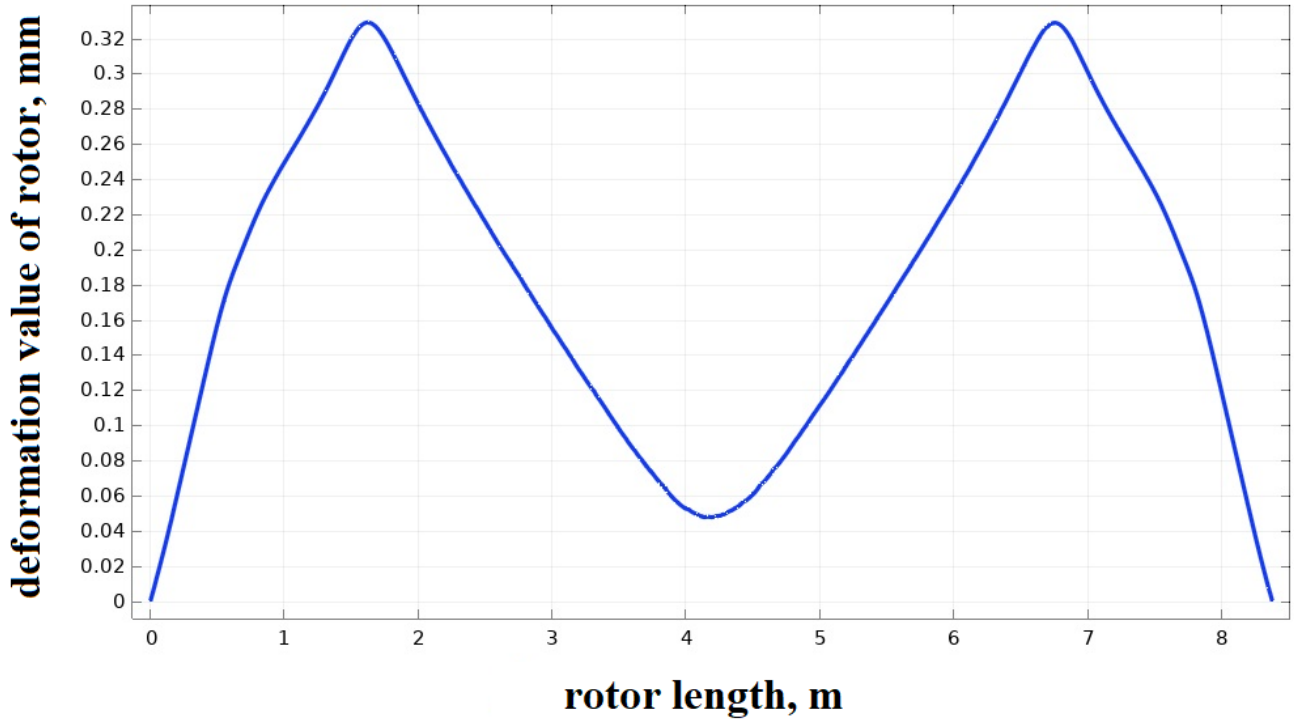
The maximum value of the rotor deformation, formed as a result of the action of the centrifugal forces from the rotor's rotation, is 0.335 mm, which is within the limits of the permissible values. The greatest values of the rotor deformation are observed at the ends of the rotor barrel, and the smallest deformation values of the TG rotor are observed in the middle of the rotor (0,048 mm) and at the ends of the rotor shaft (0 mm).

In analyzing the value of the deformation dispensations in the transverse plane of the rotor from the action of centrifugal forces, it was determined that the point in which the deformation is the smallest is shifted from the central hole of the rotor. The

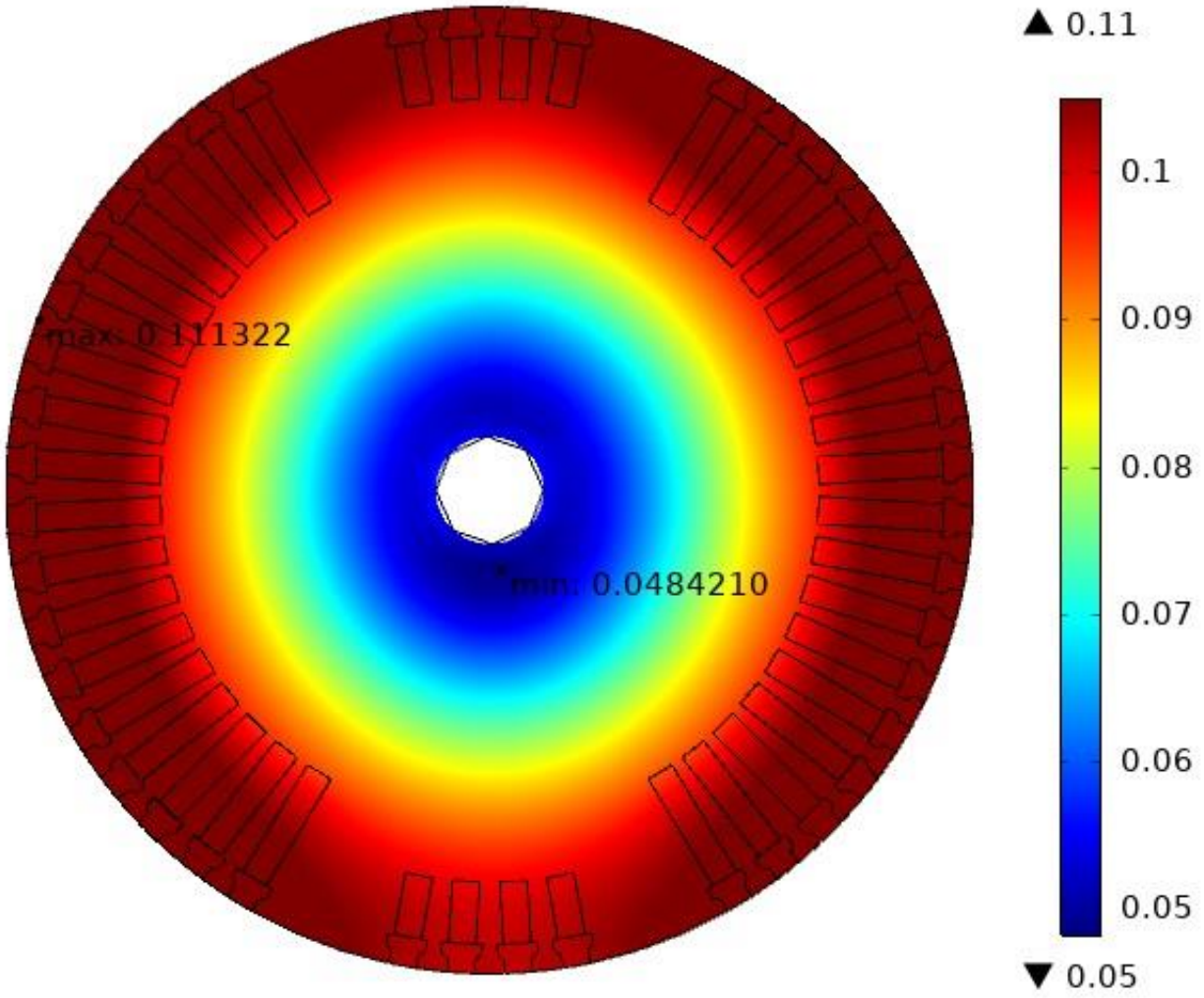
maximum values of the TG rotor deformation are observed on the outer surface of the rotor.



Picture 1 – Dispensation of the deformation value in the longitudinal plane of the TG rotor from the action of centrifugal forces (mm)



Picture 2 – Dispensation of the steel deformation value of the TG rotor along a line located 20 mm from the central hole of the rotor and in the longitudinal plane of the rotor of TG along the axis d (mm)



Picture 3 – Dispensation of the deformation values in the transverse plane of the TG rotor from the action of centrifugal forces (mm)

Conclusions. The features of the dispensation of the deformation in the rotor of turbogenerator were investigated by methods of mathematical modeling. According to the results of mathematical research, the dispensation of the deformation value in the TG rotor is determined and the value of the investigated quantity is estimated. The obtained results allow to determine areas in the TG rotor, where more attention should be paid in the process of diagnostics of rotor damage during the performance of TG planned preventive repair works.

References

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