ELSTUD 2021

Determining the level of cutting of the magnetic conductor of the transformer with the help of a contactless laser control and measuring complex

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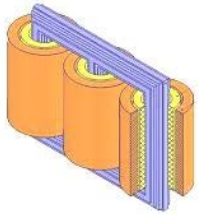
RELEVANCE

The technical condition of power transformers is determined based on the results of their monitoring and diagnostics, which makes it possible to proceed to maintenance of transformers according to their current technical condition.

The development of new, more accurate, objective, sensitive, reliable and rational methods for determining the technical condition is an urgent task of non-destructive testing of power transformers.



PURPOSE OF WORK

The purpose of this work is to improve the method of vibration control of a power transformer through the use of non-contact methods of laser vibrometry based on the analysis of informative frequencies of the amplitude spectrum of the transformer oscillations, as well as to create a laser control and measuring complex that implements the improved method.

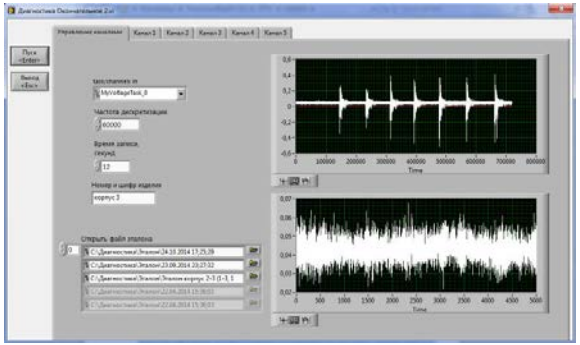


THE STRUCTURE OF THE MEASURING COMPLEX

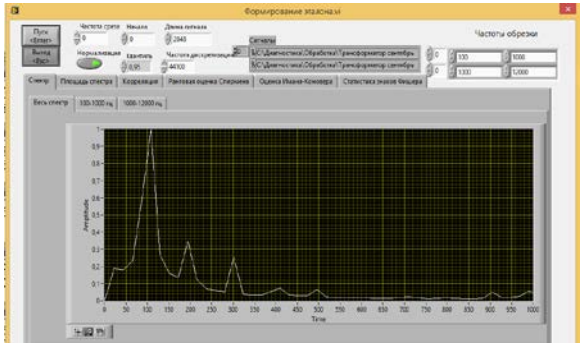
LCIK scheme:
1 - laser vibrometer PDV - 100;
2 - ADC NI USB - 6251;
3 - personal computer;
4 - LabVIEW software;
5 - power transformer

SOFTWARE MEASURING COMPLEX

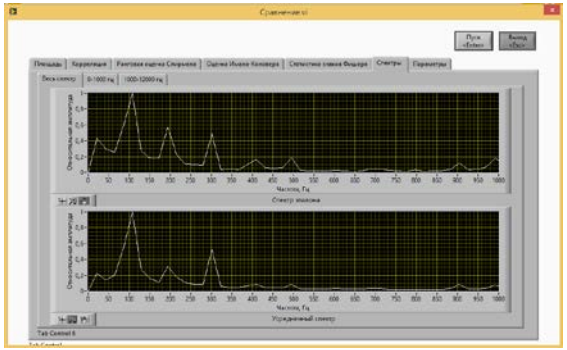
SUBROUTINE "CONTROL"



SUBROUTINE "FORMATION OF THE STANDARD"

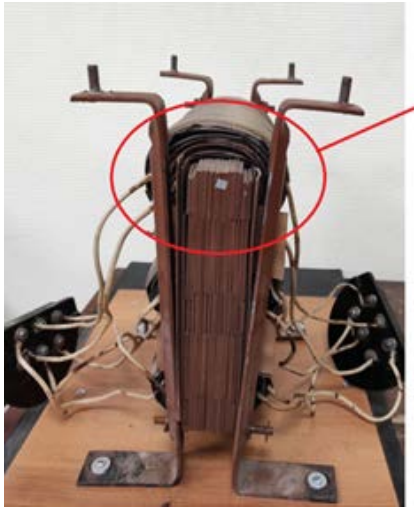


SUBROUTINE "COMPARISON WITH THE BENCHMARK"



POWER TRANSFORMER MEASUREMENTS

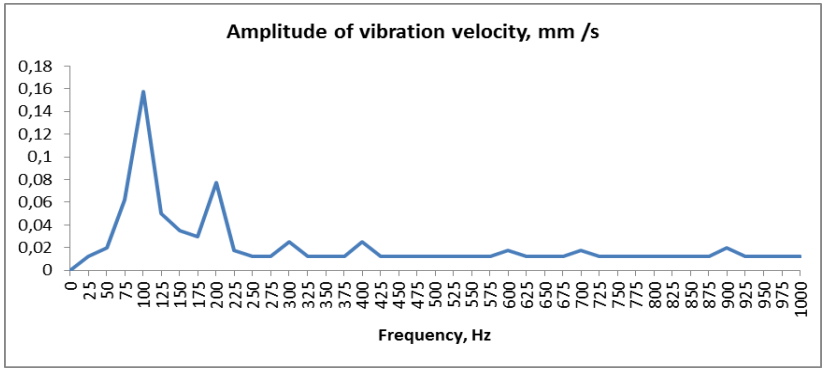
LABORATORY MEASUREMENTS



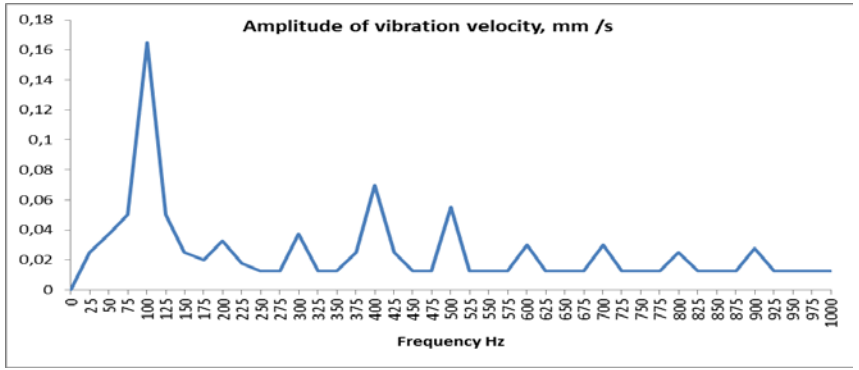
MEASUREMENT RESULTS. AMPLITUDE SPECTRUM

The amplitude spectra of the vibration velocity were formed (using the FFT) in the time interval from 0 to 0.05 s

Amplitude spectrum before magnetic circuit defect



Amplitude spectrum after magnetic circuit defect



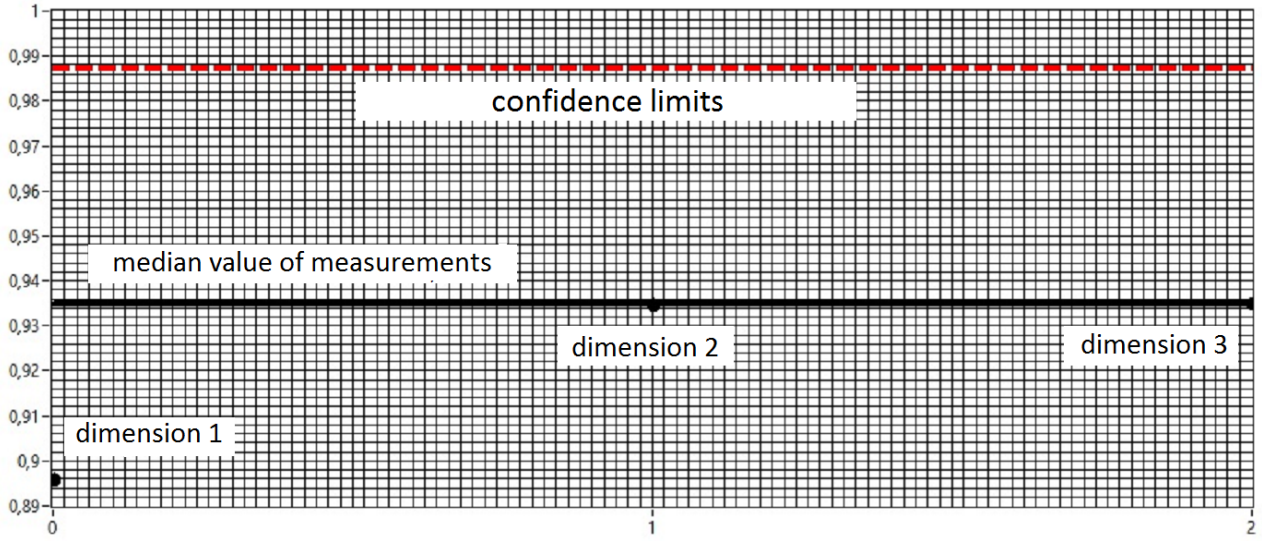
MEASUREMENT RESULTS. CORRELATION COEFFICIENT

The comparison characteristic "Correlation coefficient" is calculated by discrete frequencies by the formula:

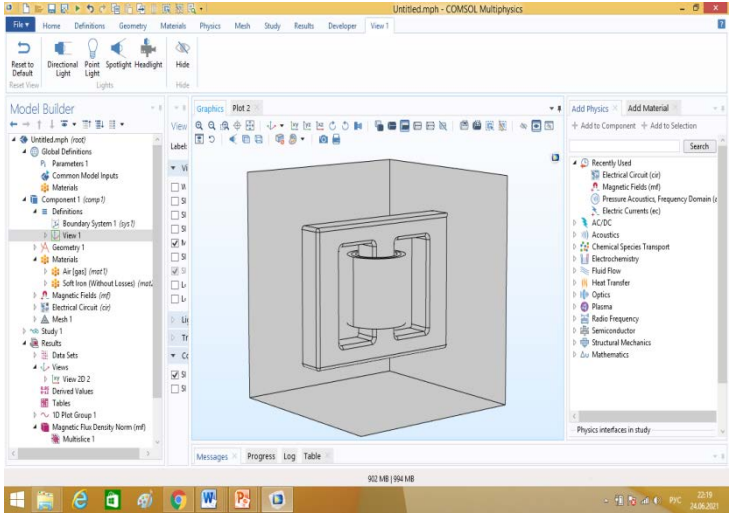
$$r = \frac{\sum a_i a_{si} - (\sum a_i \sum a_{si})/n}{\sqrt{(\sum a_i^2 - (\sum a_i)^2/n) \cdot (\sum a_{si}^2 - (\sum a_{si})^2/n)}}$$

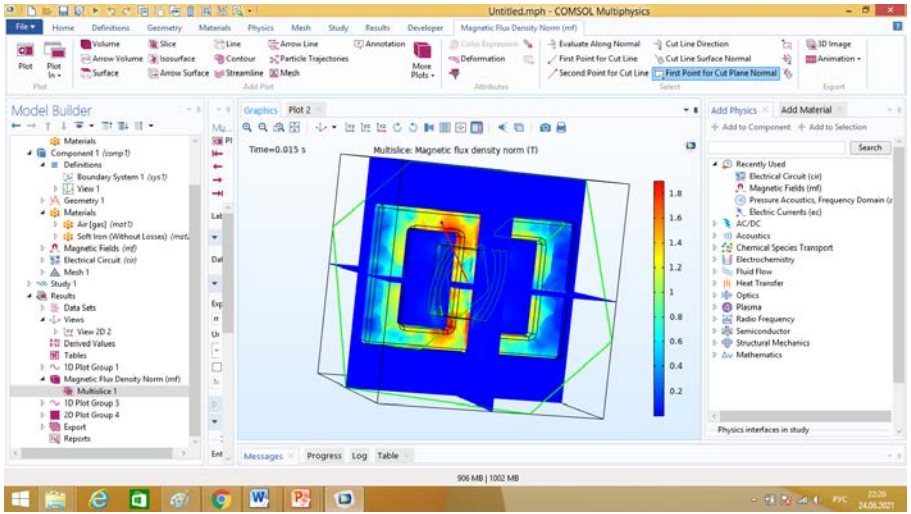
where **ai** is the amplitude at the i-th frequency of the current spectrum;
asi - amplitude at the i-th frequency of the reference spectrum;
n is the number of frequencies in the spectrum compared with the reference.

MEASUREMENTS. CORRELATION COEFFICIENT RESULTS



FURTHER WORK. COMSOL MULTIPHYSICS.





CONCLUSIONS

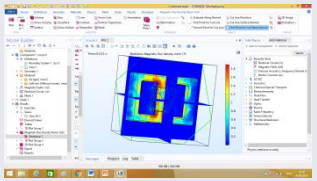
Designed and created LCMC for non-contact vibration control….

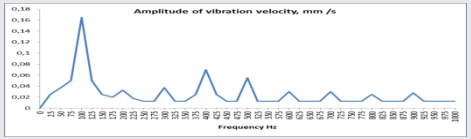
LCMC software was developed based on LabVIEW ... ..

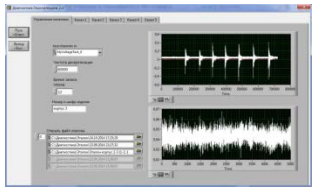
The developed LCMC with software allows ...

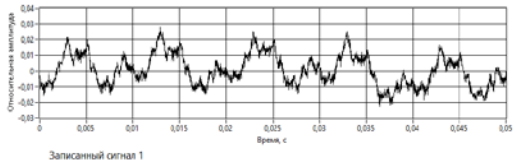
With the help of the developed LCMC ... ..

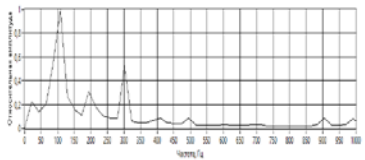
Thanks for attention!

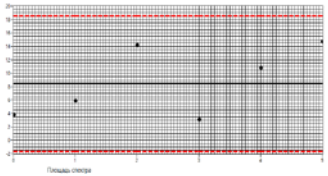


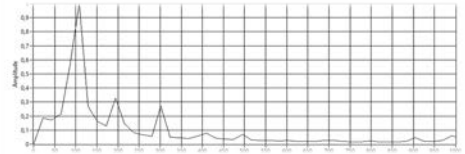












$$r = \frac{\sum a_i a_{si} - (\sum a_i \sum a_{si}) / n}{\sqrt{(\sum a_i^2 - (\sum a_i)^2 / n) \bullet (\sum a_{si}^2 - (\sum a_{si})^2 / n)}}$$