Quantitative and qualitative analysis of magnetic Barkhausen noise

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The results of the numerical analysis of magnetic Barkhausen noise (MBN) in metrological point of view, excluding the physical basis of its generating in ferromagnetic alloys, has been described. The purpose of the study was: 1) the identification of metrological features of the MBN signal (of the type of a colourful noise, the process of changes of colourful noise components); 2) identification of new diagnostic symptoms for non-destructive testing (NDT); 3) optimization of identification algorithms of new diagnostic symptoms.

Classic method of MBN analysis applied in NDT [1-3] and theoretical basis of automatic identification of the colourful noise [4] and the process of changing its components were presented. Quantitative and qualitative analysis of the MBN was performed during low cycle fatigue tests (LCF) of ferromagnetic bars with a different stress-strain state, on the basis of power spectral density function, power law depicting noise and statistic estimators. The optimization of algorithms of MBN's analysis encompasses the rule of changing the exponent of power function as a result of the preliminary data processing. The examples of results were portrayed – Figure 1.

It was experimentally shown, that there is a possibility to increase the functionality of the MBN method in applications of non-destructive testing and structural health monitoring.
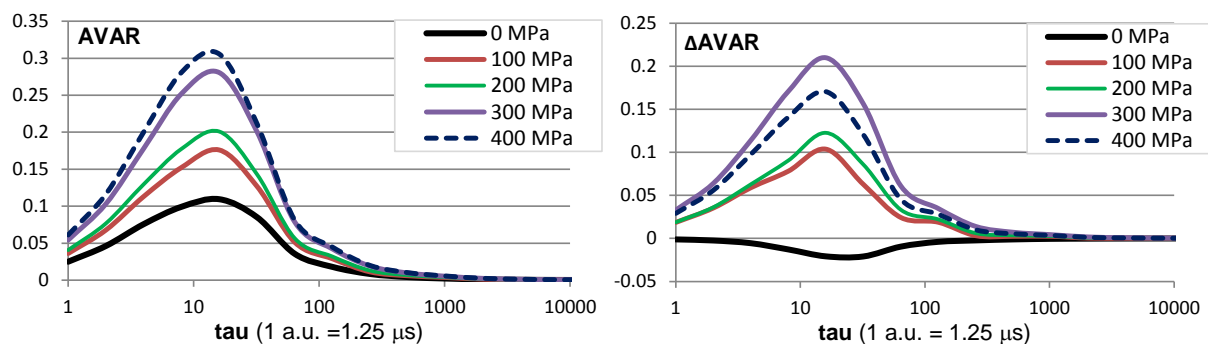

Figure 1. Left to right: the influence of stress on the Allan variance of MBN and the symptom of material anisotropy detected by the MBN (steel P91).

[1] http://www.ndt.net/search/docs.php3.

[2] Pal'a J. Ušàk E., https://doi.org/10.1016/j.jmmm.2015.11.064.

[3] Moorthy V., DOI: 10.1109/TMAG.2015.2502222.

[4] Allan D. W., DOI: 10.1109/T-UFFC.1987.26997.