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Assessment of selected parameters of the geometric structure of the surface based on mechanical and electromagnetic mapping

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Abstract

The article analyses the problem of assessing the topography of mechanical and electromagnetic surfaces obtained by various contact and non-contact scanning techniques. The electromagnetic surface of the scanned topography was obtained using various scanning techniques and methods such as Confocal, Focus Variation and coherence scanning interferometry technique and Confocal Fusion method. To improve the correlation between mechanical and electromagnetic surfaces, morphological filters were used based on two basic operations: dilation and erosion. Additionally, for the coherence scanning interferometry technique, the quality of the topography of the scanned surface was assessed using two colours of light: green and white. It was found that the use of morphological filtration has little impact on changes in roughness parameters. It was observed that the best agreement between electromagnetic and mechanical surfaces was obtained when working with the interferometry technique.

Bibliography

- [1] Blateyron F.: Good practices for the use of areal filters, Conference Paper Digital Surf, May 2014, DOI: 10.13140/2.1.1007.9361.
- [2] Broekel T.: Measuring Technological Complexity-Current Approaches and a New Measure of Structural Complexity, 2017, arXiv preprint arXiv: 1708.07357, <https://arxiv.org/pdf/1708.07357.pdf>
- [3] Bruzzone A.A.G., Costa H.L., Lonardo P.M., Lucca D.A.: Advances in engineered surfaces for functional performance, CIRP Annals - Manufacturing Technology 57 (2008) 750–769.
- [4] Cheng, Y., Wang, Y., Lin, J. et al. Research status of the

- influence of machining processes and surface modification technology on the surface integrity of bearing steel materials. *Int J Adv Manuf Technol* 125, 2897–2923 (2023).
<https://doi.org/10.1007/s00170-023-10960-x>
- [5] DIGITAL SURF - MountainsMap User Manual
<https://guide.digitalsurf.com/en/guide.html> 19.
- [6] Gadelmawla ES, Koura MM, Maksoud TMA, Elewa IM, Soliman HH. Roughness parameters. *J MaterProcess Technol* 2002;123(1):133–45.
[https://doi.org/10.1016/S0924-0136\(02\)00060-2](https://doi.org/10.1016/S0924-0136(02)00060-2).
- [7] Krolczyk G.M., Maruda R.W., Krolczyk J.B., Nieslony P., Wojciechowski S., Legutko S., Parametric and nonparametric description of the surface topography in the dry and MQCL cutting conditions, *Measurement* 121 (2018) 225–239.
- [8] Maruda R. W., Wojciechowski S., Szczotkarz N., Legutko S., Mia M., Gupta M. K., Nieslony P., Krolczyk G. M., Metrological analysis of surface quality aspects in minimum quantity cooling lubrication. *Measurement*, (2021), vol. 171, s. 108847-1-108847-12.
- [9] Mu YZ, He TT, Shao RN, Zheng XM, Cui T, Du SM, Zhang YZ (2021) Effect of quenching holding time properties of on micro-structure and friction and wear GCr15 bearing steel. *Trans Mater Heat Treat* 42:109–116.
<https://doi.org/10.13289/j.issn.1009-6264.2021-0253>.
- [10] Niemczewska-Wójcik M., Wójcik A., The machining process and multi-sensor measurements of the friction components of total hip joint prosthesis, *Measurement* 116 (2018) 56–67.
- [11] Niemczewska-Wójcik M., Wójcik A: The multi-scale analysis of ceramic surface topography created in abrasive machining process, *Measurement*, Vol. 166, 2020, ISSN 0263-2241,
<https://doi.org/10.1016/j.measurement.2020.108217>.
- [12] Nieslony P., Cichosz P., Krolczyk G.M., Legutko S., Smyczek D., Kolodziej M., Experimental studies of the cutting force and surface morphology of explosively clad Ti-steel plates. *Measurement.*, 78 (2016), pp. 129-137,
[10.1016/j.measurement.2015.10.005](https://doi.org/10.1016/j.measurement.2015.10.005).
- [13] Nieslony P., Krolczyk G.M., Wojciechowski S., Chudy R., Zak K., Maruda R.W., Surface quality and topographic inspection of variable compliance part after precise turning. *Applied Surface Science* Volume 434, 15 March 2018, Pages 91-101.
- [14] Nieslony P., Krolczyk G.M., Zak K., Maruda R.W., Legutko S., Comparative assessment of the mechanical and electromagnetic surfaces of explosively clad Ti-steel plates after drilling proces, *Precis. Eng.* 47 (2017) 104–110.
- [15] Pawlus P., Reizer R., Wieczorowski M., Krolczyk G.M., Sensitivities of surface texture parameters to measurement errors – A review, *Measurement*, Volume 227, 2024, ISSN 0263-2241, <https://doi.org/10.1016/j.measurement.2024.114323>
- [16] Serope K., Schmid S.: *Manufacturing Engineering and Technology in SI Units*, Pearson Education, 2022, 1312pp.
- [17] Thiele J.D., Melkote S.N., Peascoe R.A., Watkins T.R. (2000)

Effect of cutting edge geometry and workpiece hardness on surface residual stresses in finish hard turning of AISI 2100 steel. J Manuf Sci Eng 122:642-649.

[18] Youssef, Helmi A.; El-Hofy, Hassan A.; Ahmed, Mahmoud H.: Manufacturing Technology, Pevná, 2023, ISBN: 9781032432489, 920 pp.

[19] ISO 16610-40: GPS - Filtration - Morphological profile filters: Basic concepts.

[20] ISO 16610-41: GPS - Filtration - Morphological profile filters: Disk and line segment filters.

[21] ISO 16610-80: GPS - Filtration - Morphological areal filters: Basic concepts.

[22] ISO 16610-81: GPS - Filtration - Morphological areal filters: Sphere and planar segment filters.

[23] ISO 25178: Geometrical Product Specifications (GPS), collection of international standards relating to the analysis of 3D areal surface texture.

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