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## Precise Frequency-Pattern Analysis Reveals the Functional Structure of Complex Systems

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A method for the analysis of complex oscillating electrical systems was proposed [1], based on the multi-channel measurements of magnetic field through the hundreds of seconds. Using whole registration time, the Fourier transform of the data is performed, leading to detailed spectra with many frequency components. Further analysis results in total decomposition of the system into functionally invariant entities, each of them having invariant field pattern. The method of functional tomography is described, making it possible to distribute in space the energy of magnetic field sources. Method was verified on the physical phantoms with highly satisfactory results. This approach was applied in different studies of the human brain [2], heart and hand, providing the three-dimensional arrays of sources distribution in the space of measurement. Generally corresponding to anatomy of the systems under study, those 3D arrays reveal their functional structure. Recently the method was successfully applied to localization of magnetic nanoparticles without pre-magnetization or displacement of the sample [3].

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3. Polikarpov M.A., Ustinin M.N., Rykunov S.D., Yurenaya A.Y., Naurzakov S.P., Grebenkin A.P., Panchenko V.Y. 3D imaging of magnetic particles using the 7-channel magnetoencephalography device without pre-magnetization or displacement of the sample // *Journal of Magnetism and Magnetic Materials*. 2017. Vol. 427. P. 139–143. doi:10.1016/j.jmmm.2016.10.055.

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