

Optical Vortex Scanning Microscope

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Abstract

The Optical Vortex Scanning Microscope (OVSM) is based on the Mach–Zehnder interferometer with carrier frequency. The conventional Gaussian beam (from He-Ne laser) passes through the spiral phase plate and is focused on the sample plane, where it interacts with the investigated object. The sample plane is magnified and imaged into the CCD camera. The interferometer's reference arm enables detection of the interference fringes, from which the internal structure of the object beam can be recovered. An analytical description of the OVSM in the scalar Fresnel approximation was presented in paper [1]. The first image recovery procedures were proposed basing on this theory and were tested with simple phase objects. These first results were presented in paper [2].

In this presentation, I will briefly discuss the theory of the OVSM. Special attention will be put to the internal scanning method (ISM). The ISM enables scanning the sample just by vortex point at the sample plane, while the whole focused beam stays in place. This method is very precise and resistant to mechanical vibration. Images resolved with resolution exceeding the classical diffraction limit will be presented. At this stage, simple phase structures can be imaged. Possible directions of the OVSM development will be discussed in brief.

About the presenter

Jan Masajada received his Ph.D. degree (in the field of holography) from the Institute of Physics, Wrocław University of Science and Technology, Wrocław, in 1992. Next, he joined the Faculty of Fundamental Problems of Technology, Wrocław University of Science and Technology, where he currently works as University Professor. In 1993–1995, he worked with the team promoting security holograms in Poland (presently Hologram Industries Poland). He was a secretary of Optical Section of Polish Physical Society (affiliated member of EOS), secretary of Lower Silesian Chapter of Polish Physical Society (2012–2013), and member of Board of Lower Silesian Chapter of Polish Physical Society (2014–2015). His current research interests include the theory and applications of optical singularities especially in the field of interferometry, optical manipulation, and superresolution microscopy.

References

- [1] Łukasz Płociniczak, Agnieszka Popiołek-Masajada, Jan Masajada, and Mateusz Szatkowski. Analytical model of the optical vortex microscope. *Applied Optics*, 55(12):B20–B27, 2016.
- [2] Agnieszka Popiołek-Masajada, Jan Masajada, and Mateusz Szatkowski. Internal scanning method as unique imaging method of optical vortex scanning microscope. *Optics and Lasers in Engineering*, 105:201–208, 2018.