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TECHNOLOGY INFO SHEET

Improvement of resolution and image quality by optical tomographic microscope

Development status

- Proof of concept
- Development
- **Product development and Testing**
- Entering to market
- Market development

IP status

- In priority year
- PCT I.
- PCT II.
- National/regional phase
- **Validation**

Challenge

The features of optical imaging systems include the later resolution as well as the contrast of the image created by the microscope. The relevant quantitative characteristics of the system are the Rayleigh resolution and the optical transfer functions. However, conventional microscopes cannot create an image of the object smaller than the Rayleigh resolution limit. Although in such cases it is possible to increase the numerical aperture of the lens, but this solution has theoretical and technical limitations and it is also rather costly.

Technology

The effect of center of rotation error was investigated caused by image rotating prism and rotator in line-scanning tomographic optical microscope (LSTOM) using numerical simulations and ray-tracing. A confocal LSTOM microscope was constructed with fluorescent imaging capability. The captured images are error-free with a resolution improvement of 17% compared to a traditional widefield microscope. The lateral resolution of a line scanning microscope was improved by 37% applying phase apodization on the illumination combined by confocal detection. This new optical microscope system and image reconstruction method can resolve smaller patterns than the Rayleigh resolution limit by using traditional optical elements.

Keywords

Optical microscope, Rayleigh resolution limit, zomography

Benefits

- This microscope uses filtered back projection (BPF) for image reconstruction.
- Objects can be scanned from several directions.
- The lateral resolution of the optical microscope system increases with the number of applied scan and scanning directions.
- Using the confocal mode, even a 3D image can be created from the object.
- This microscope is appropriate for examining biological samples (e.g. multiphoton microscopy, immersion fluids), thus its field of usage is also expanded.

Development status

The prototype of the microscope was developed and produced under laboratory conditions.

Using this refinement method, fluorescent biological samples (rat brain) have already been examined.

IP status

The PCT examination has been extended to a US patent (US 12/867,984). The US patent was granted in 2014. (Patent No.: 8 693 091).

What we are looking for

The University of Szeged is seeing industrial partners – mostly optical microscope manufacturers – who are interested in developing the prototype and launching the product on the market.

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