Efficient simulation of autofluorescence effects in microscopic lenses - DTU Orbit
(30/08/2018)

Efficient simulation of autofluorescence effects in microscopic lenses

The use of fluorescence in microscopy is a well known technology today. Due to the autofluorescence of the materials of the optical system components, the contrast of the images is degraded. The calculation of autofluorescence usually is performed by brute force methods as volume scattering. The efficiency of calculations in this case is extremely low and a huge number of rays must be calculated. In stray light calculations the concept of important sampling is used to reduce computational effort. The idea is to calculate only rays, which have the chance to reach the target surface. The fluorescence conversion can be considered to be a scatter process and therefore a modification of this idea is used here. The reduction factor is calculated by simply comparing in every z-plane of the lenses the size of the illuminated phase space domain with the corresponding acceptance domain. The boundaries of the domains are determined by simple tracing of the limiting rays of the light cone of the source as well as the pixel area under consideration. The small overlap of both domains can be estimated by geometrical considerations. The correct photometric scaling and the discretization of the volumes must be performed properly. Some necessary approximations produce negligible errors. The improvement in run time is in the range of 10^4. It is shown with some practical examples of microscopic lenses, that the results are comparable with conventional methods. The limitations and the consequences for questions of the lens design are discussed.

General information
State: Published
Organisations: Department of Photonics Engineering, Optical Sensor Technology, Friedrich-Schiller-Universität Jena, Fraunhofer-Institut für Angewandte Optik und Feinmechanik
Authors: Gross, H. (Ekstern), Rodenko, O. (Intern), Esslinger, M. (Ekstern), Tünnermann, A. (Ekstern)
Number of pages: 7
Publication date: 2015

Host publication information
Title of host publication: Proceedings of SPIE
Volume: 9626
Publisher: SPIE - International Society for Optical Engineering
Article number: 962609
ISBN (Print): 9781628418156

Series: Proceedings of SPIE, the International Society for Optical Engineering
Volume: 9626
ISSN: 0277-786X
Main Research Area: Technical/natural sciences
Conference: Optical Design and Engineering, Jena, Germany, 07/09/2015 - 07/09/2015
Microscopy, Autofluorescence, Straylight, Contrast, Simulation
Electronic versions:
962609_1.pdf
DOIs:
10.1117/12.2191260

Bibliographical note
Copyright 2015 Society of Photo Optical Instrumentation Engineers. One print or electronic copy may be made for personal use only. Systematic electronic or print reproduction and distribution, duplication of any material in this paper for a fee or for commercial purposes, or modification of the content of the paper are prohibited.
Source: PublicationPreSubmission
Source-ID: 117758704
Publication: Research - peer-review › Article in proceedings – Annual report year: 2015