



Computational Fourier Optics

A MATLAB® Tutorial

David Voelz

Computational Fourier Optics A Matlab Tutorial Spie Tutorial Texts Vol Tt89

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Caulfield**



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Nanoscale Photonic Imaging Tim Salditt, Alexander Egner, D. Russell Luke, 2020-06-09 This open access book edited and authored by a team of world leading researchers provides a broad overview of advanced photonic methods for nanoscale visualization as well as describing a range of fascinating in depth studies Introductory chapters cover the most relevant physics and basic methods that young researchers need to master in order to work effectively in the field of nanoscale photonic imaging from physical first principles to instrumentation to mathematical foundations of imaging and data analysis Subsequent chapters demonstrate how these cutting edge methods are applied to a variety of systems including complex fluids and biomolecular systems for visualizing their structure and dynamics in space and on timescales extending over many orders of magnitude down to the femtosecond range Progress in nanoscale photonic imaging in G ttingen has been the sum total of more than a decade of work by a wide range of scientists and mathematicians across disciplines working together in a vibrant collaboration of a kind rarely matched This volume presents the highlights of their research achievements and serves as a record of the unique and remarkable constellation of contributors as well as looking ahead at the future prospects in this field It will serve not only as a useful reference for experienced researchers but also as a valuable point of entry for newcomers

X-Ray Near-Field Holography: Beyond Idealized Assumptions of the Probe Johannes Hagemann, 2017 All images are flawed no matter how good your lenses mirrors etc are Especially in the hard X ray regime it is challenging to manufacture high quality optics due to the weak interaction of multi keV photons with matter This is a tremendous challenge for obtaining high resolution quantitative X ray microscopy images In recent years lensless phase contrast imaging has become an alternative to classical absorptionbased imaging methods Without any optics the image is formed only by the free space propagation of the wave field The actual image has to be formed posteriori by numerical reconstruction methods Advanced phasing methods enable the experimentalist to recover a complex valued specimen from a single or a set of intensity measurement This would be the ideal case reality teaches us that there are no ideal imaging conditions Describing understanding and circumventing these non ideal imaging conditions and their effects on X ray near field holographic NFH imaging are the leitmotifs for this thesis In NFH the non ideal conditions manifest themselves in the illuminating wave field or probe The probe generally does not satisfy the canonical assumptions of fully coherent and monochromatic radiation emitted by a point source The main results of this thesis are compiled as a collection of publications An approach is shown to reconstruct the probe of a X ray nano focus setup by a series of measurements of the probe at varied Fresnel number The following chapter presents a study concerning the reconstruction efficiency in terms of resolution for near and far field based lensless imaging In the following the reconstruction scheme for the probe is extended to incorporate the effects of partial coherence in the near field This enables the recovery of the modal structure of the probe which yields a full description of its coherence properties Giving up the assumption of temporal stability due to the stochastic pulses delivered by X ray free

electron lasers the reconstruction of probe and specimen must be achieved from a single shot A suitable scheme for this purpose is proposed in this work

Biomedical Imaging Tim Salditt,Timo Aspelmeier,Sebastian Aeffner,2017-10-23
Covering both physical as well as mathematical and algorithmic foundations this graduate textbook provides the reader with an introduction into modern biomedical imaging and image processing and reconstruction These techniques are not only based on advanced instrumentation for image acquisition but equally on new developments in image processing and reconstruction to extract relevant information from recorded data To this end the present book offers a quantitative treatise of radiography computed tomography and medical physics Contents Introduction Digital image processing Essentials of medical x ray physics Tomography Radiobiology radiotherapy and radiation protection Phase contrast radiography Object reconstruction under nonideal conditions

Computational Fourier Optics Jim Bernard Breckinridge,David George Voelz,2011 Computational Fourier Optics is a text that shows the reader in a tutorial form how to implement Fourier optical theory and analytic methods on the computer A primary objective is to give students of Fourier optics the capability of programming their own basic wave optic beam propagations and imaging simulations The book will also be of interest to professional engineers and physicists learning Fourier optics simulation techniques either as a self study text or a text for a short course For more advanced study the latter chapters and appendices provide methods and examples for modeling beams and pupil functions with more complicated structure aberrations and partial coherence For a student in a course on Fourier optics this book is a concise accessible and practical companion to any of several excellent textbooks on Fourier optical theory

The New Physical Optics Notebook G.O. Reynolds,1989 Approaches the topic of physical optics with examples drawn from the physical processes described Includes chapters on Fourier transforms image formation optical coherence diffraction interference holography interferometry analog optical computing synthetic aperture imaging and others Contains more than 600 photographs and line drawings and more than 650 references

Fourier Ptychographic Imaging Guoan Zheng,2016 This book demonstrates the concept of Fourier ptychography a new imaging technique that bypasses the resolution limit of the employed optics In particular it transforms the general challenge of high throughput high resolution imaging from one that is coupled to the physical limitations of the optics to one that is solvable through computation Beginning as a collection of lecture notes and MATLAB simulation examples this book has grown to include discussions on the experimental implementation and recent developments in the teaching of the Fourier ptychography technique In teaching this technique in a graduate course students were able to develop a better conceptual understanding of Fourier ptychography This book will be of interest to researchers and engineers learning simulation techniques for Fourier optics and the Fourier ptychography concept

The New Physical Optics Notebook G.O. Reynolds,J.B. De Velis,G.B. Parrent,B.J. Thompson,2000-09-01

The New Physical Optics Notebook Tutorials In Fourier Optics G.O. Reynolds, [Selected Papers on Fourier Optics](#) Mustafa A. G. Abushagur, Henry John Caulfield,1995 SPIE Milestones are collections of seminal papers

from the world literature covering important discoveries and developments in optics and photonics *Field Guide to Linear Systems in Optics* J. Scott Tyo, Andrey S. Alenin, 2015-01-01 Linear systems is a broad and important area in many scientific and engineering disciplines and it is especially important in optics because it forms the basis for Fourier optics diffraction theory image quality assessment and many other areas This Field Guide provides the practicing optical engineer with a reference for the basic concepts and techniques of linear systems including Fourier series continuous and discrete Fourier transforms convolution sampling and aliasing and MTF PSF using the language notation and applications from optics imaging and diffraction

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