ap

ASIAN JOURNAL OF PHYSICS

An International Quarterly Research Journal

AJP

SSN : 0971 - 3093
Vol 23, No. 3, July - Sept, 2014

Asian Journal of Physics Vol. 23, No 3 (2014) 303-332

Introduction to optical signal processing

Shi Liu[a], Changliang Guo[a] and John T Sheridan[a]

[a]*School of Electrical, Electronic and Communication Engineering, College of Engineering and Architecture, Communication and Optoelectronic Research Centre, The SFI-Strategic Research Cluster in Solar Energy Conversion, University College Dublin, Belfield, Dublin 4, Ireland*

This paper presents an overview of recent developments in the area of linear optical signal processing (OSP) under the paraxial approximation. The availability of high quality spatial light modulators (SLM) and high resolution digital cameras make it more feasible to implement many OSP functions. Some fundamental concepts concerning basic Fourier analysis and functions are described for such systems. Then the Fourier transform (FT), the optical Fourier transform (OFT), the discrete Fourier transform (DFT), the fractional Fourier transform (FRT), the Fresnel transform (FST), and the general case of the linear canonical transform (LCT) are discussed. In particular two significant applications of OSP, i.e. optical encryption systems and digital watermarking techniques, are reviewed including basic optical systems and numerical algorithms. Some publications indicating how these concepts have been successfully applied over many years by Kehar Singh *et al* are referenced.

Total Refs : 210

Introduction to optical signal processing.pdf
Shi Liu, Changliang Guo and John T Sheridan

Asian Journal of Physics Vol. 23, No 3 (2014) 333-342

Holography: Rediscovery, Development, and Beyond

Francis T S Yu

Electrical Engineering Department, Penn State University Park, PA 16802, USA

There are basically two-types of holography that have been developed and they are : Leith's transmission-type holography and Denisyuk's reflection-type holography. Nevertheless, the rediscovery of holography must be due to the discovery of laser. In other words, without the discovery of this coherent light source, holography may not have been rediscovered! Nevertheless, the original purpose of the development of holography was to produce a true three-dimensional image by means of wave front reconstruction. Since the rediscovery, it has offered a much wider application beyond its legacy!

Total Refs : 14

Asian Journal of Physics Vol. 23, No 3 (2014) 343-351

Non-linear Fourier optics in computers: a challenge for hybrid digital-optical image processors

L Yaroslavsky
Department of Physical Electronics, School of electrical Engineering,
Tel Aviv University, Tel Aviv 69978, Israel

In the paper, a family of methods that work in the domain of Discrete Fourier and Discrete cosine transforms and proved to be very efficient for adaptive and local adaptive image restoration and target location is reviewed and possible ways for their implementation in analog optical image processors that work with the speed of light are discussed.
Total Refs : 8

non-linear fourier optics in computers: a challenge for hybrid digital-optical image processors.pdf
L Yaroslavsky

Asian Journal of Physics Vol. 23, No 3 (2014) 353-362

From optical neural networks to the art of learning

Francis T S Yu
Emeritus Evan Pugh Professor of Electrical Engineering
Penn State University, University Park, PA 16802, USA

Common sense tells us that, if we knew the basic constraints and abilities of our neural network, then more efficient learning and educational methods can be devised. There are a couple of fundamental questions: Are we educating our students efficiently? The answer to this question is apparently no! How can we improve it? It can be improved with innovative educational methods, as will be discussed in this paper.
Total Refs : 2

Asian Journal of Physics Vol. 23, No 3 (2014) 363-402

Pupil filters in optical systems. Implementation in liquid crystal spatial light modulators

Juan Campos[1], Juan C Escalera[1], Andrés Márquez[2,3], and María J Yzuel[1]
[1]Departamento de Física, Universidad Autónoma de Barcelona, 08193 Bellaterra, Spain;
[2]Depto de Física, Ingeniería de Sistema y Teoría de la Señal, Universidad de Alicante, Ap. 99, E-03080 Alicante, Spain
[3]I.U. Física Aplicada a las Ciencias y las Tecnologías, Universidad de Alicante, Ap. 99, E-03080, Alicante, Spain

In this paper we review the use of liquid crystal spatial light modulators (LC-SLM) for implementing pupil filters in optical systems. We intend to cover three topics. Firstly, we will study different types of amplitude, phase and complex filters and their effects onto the transverse and axial behavior of an optical system. Secondly, we will describe how to control the amplitude and the phase in an LC-SLM in order to be capable of implementing pupil filters on it. Finally, we will show experimental results of these set-ups improving diverse features of the response of an optical system.
Total Refs : 103

Asian Journal of Physics Vol. 23, No 3 (2014) 403-414

About the future of optical computing

Joseph Shamir
Department of Electrical Engineering
Technion – Israel Institute of Technology, Haifa 32000, Israel

Interest in signal processing and computing using light was triggered by the invention of the laser and flourished during about three decades starting in 1960. Optical methods were first introduced for analog signal processing paradigms but early attempts toward optical digital processing failed due to fundamental misconceptions. To assess the trends for the future, the first part of the paper is devoted mainly to a historical overview while the second part shows that some novel concepts and advanced technology may revitalize optical signal processing also within the digital computing world. This latter development is demonstrated by digital logic functions implemented on simple electro-optic networks.
Total Refs : 46

about the future of optical computing.pdf
Joseph Shamir Asian Journal of Physics

Asian Journal of Physics Vol. 23, No 3 (2014) 415-424

Novel zoom systems using a vortex pair

Jorge Ojeda-Castaneda, Cristina M Gómez-Sarabia and Sergio Ledesma
Electronics Department and Digital Arts Department, University of Guanajuato
Campus Irapuato Salamanca, Salamanca 36885, Guanajuato, México

We describe the use of two refractive elements that have helical phase variations, here denoted as a vortex pair, for implementing varifocal lenses. Next, we employ vortex pairs for setting several nonconventional optical zoom systems. First, we discuss the Gaussian optics characteristics of single lens zoom system. Then, we describe a tunable afocal attachment, which is later employed for implementing a telephoto system whose elements are at fixed positions. Finally, we discuss a nonconventional zoom system, and we unveil a confocal device that scans axially a volumetric sample.
Total Refs : 13

Novel zoom systems using a vortex pair.pdf
Jorge Ojeda-Castaneda, Cristina M Gómez-Sarabia and Sergio Ledesma

Asian Journal of Physics Vol. 23, No 3 (2014) 425-432

Optical scattering of anisotropic nanocylinder evaluated by T-matrix mehod

Yunlong Sheng
Center for Optics, Photonics and Lasers,
Department of Physics, Physical Engineering and Optics
Laval University, Quebec, G1V 0A6, Canada

The T-matrix method with the Vector Spherical Wave Function (VSWF) expansions represents some difficulties for computing optical scattering of anisotropic particles. As the divergence of the electric field is nonzero in the anisotropic medium and the VSWFs do not satisfy the anisotropic wave equations one questioned whether the VSWFs are still a suitable basis in the anisotropic medium. We made a systematic and careful review on the vector basis functions and the VSWFs. We found that a field vector in Euclidean space can be decomposed to triplet vectors {L, M, N}, which is non-coplanar. Especially, the vector L is designed to represent non-zero divergence component of the vector solution, so that the VSWF basis is sufficiently general to represent the solutions of the anisotropic wave equation. The mathematical proof can be that when the anisotropic wave equations is solved in the Fourier space, the solution is expanded in the basis of the plane waves with angular spectrum amplitude distributions. The plane waves constitute an orthogonal and complete set for the anisotropic solutions. Furthermore, the plane waves are expanded into the VSWF basis. These two-step expansions are equivalent to the one-step direct expansion of the anisotropic solution to the VSWF basis. We used direct VSWF expansion along with the point-matching method in the T-matrix, and applied the boundary condition to the normal components displacement field in order to compute the stress and the related forces and torques and to show the mechanism of the optical trap of the anisotropic nano-cylinders.
Keywords: Optical Scattering; Anisotropic medium, T-matrix,Vector spherical wave functions, Vector field expansion, Complete function set.
Total Refs : 15

Back Top