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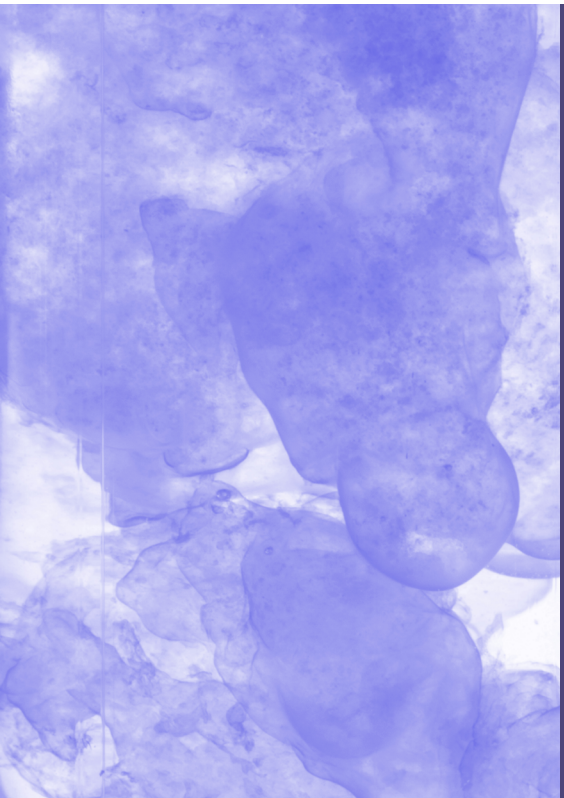
Section
Optics and Lasers



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Section Information

The section of Optics and Lasers is open to receive high-quality papers reporting state-of-the-art technology in the fields of optics and lasers, which includes non-linear optics such as high-order harmonics, Raman, wave-mixing, multiphoton ionization, as well as other basic phenomena in this field. The section welcomes rudimentary and challenging studies concerning optical devices, such as photonic crystal fibers and micro-scale optics for fabrication of novel optical systems. Needless to say, production of lasers with unique properties, such as a high-power fiber laser or facilitating a large-scale laser system, are of great importance in this section. By contrast, studies focusing on data analyses methods or simulation based on traditional techniques should be sent to a different specialized journal.

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Content Highlights

State of the Art of High-Flux Compton/Thomson X-rays Sources

Authors: Vittoria Petrillo, Illya Drebot, Marcel Ruijter, Sanae Samsam, Alberto Bacci, Camilla Curatolo, Michele Opromolla, Marcello Rossetti Conti, Andrea Renato Rossi and Luca Serafini

Abstract: In this paper, we present the generalities of the Compton interaction process; we analyse the different paradigms of Inverse Compton Sources, implemented or in commissioning phase at various facilities, or proposed as future projects. We present an overview of the state of the art, with a discussion of the most demanding challenges.

https://doi.org/10.3390/app13020752

A Novel 3D Topography Stitching Algorithm Based on Reflectance and Multimap

Authors: Julie Lemesle, Robin Guibert and Maxence Bigerelle

Abstract: Surface topography is an efficient tool for the understanding of physical phenomena, especially if multiscale roughness analysis is performed. However, the observable scale range in a topography measured with 3D optical profilometers is quite limited. Therefore, all scales linked to a physical phenomenon might not be measured, which impedes the correct analysis of the surface. Stitching of 3D topographies, a technique combining elementary topographic maps into a larger one, can be used to increase the scale range for an objective lens. A high resolution over a large field of measurement topography is then generated. A literature review of 3D topography stitching algorithm highlights the stitching procedure, and detailed explanations on in-plane registration algorithms are provided. However, some existing 3D topography stitching algorithms are not sufficiently accurate for the registration of surface, especially at smaller scales. This paper proposes a new reflectance-based multimap 3D stitching algorithm and three of its variants. These algorithm variants are compared to three existing 3D stitching algorithms (geometric, cross-correlation and global optimization of differences) on four test cases, containing measured elementary topographic maps obtained on four surfaces and with four 3D optical profilometers (two focus variation microscopes and two interferometers). Five qualitative and quantitative criteria and indicators are proposed for the comparison of 3D topography stitching algorithms: visual inspection, run time, memory usage, mean repositioning error and stitching error estimator. Lastly, two quantitative indicators and criteria are new indicators proposed in this article. Overall, the new 3D stitching algorithms based on reflectance and multimaps have a lower mean repositioning error and stitching error estimator compared to other existing algorithms. This highlights the relevance of multimap stitching algorithms in the case of 3D topographies. A new decision-helping tool, the stitching gain lift plot (SGL plot), is described for the selection of the best stitching algorithm for a given test case...

https://doi.org/10.3390/app13020857

Development of a New Eye Movement Measurement Device Using Eye-Tracking Analysis Technology

Authors: Shunya Tatara, Haruo Toda, Fumiatsu Maeda and Tomoya Handa

Abstract: Smooth pursuit eye movements and saccadic eye movements are vital for precise vision. Therefore, tests for eye movement are important for assessing nervous or muscular diseases. However, objective measurements are not frequently performed due to the need for a polygraph system, electrodes, amplifier, and personal computer for data analysis. To address this, we developed an all-in-one eye-movement-measuring device that simultaneously presents visual stimuli, records eye positions, and examines its feasibility for evaluating eye movements. This device generates stimulus that induces eye movements and records those movements continuously. The horizontal or vertical eye movements of 16 participants were measured at various visual target speeds of 20–100 deg/s. The maximum cross-correlation coefficient (rho max) between the eye and visual target positions was used as an index of eye movement accuracy. A repeated-measures multi-way analysis of variance was performed, with the main effect being that rho max significantly decreased as the visual target speed increased...

https://doi.org/10.3390/app13105968

O-Band Grating Couplers Using Silicon Nitride Structures

Authors: Eli Ohana and Dror Malka

Abstract: To test silicon photonics component performances, a silicon (Si) grating coupler (GC) is used to couple the light from a single-mode fiber (SMF) into the chip. However, silicon nitride (Si_3N_4) waveguides have recently become more popular for realizing photonic integrated circuits (PICs), which may be attributable to their exceptional characteristics, such as minimal absorption and low back reflection (BR) in the O-band spectrum. Thus, to test the photonic chip, a waveguide converter from Si_3N_4 to Si needs to be added to the photonic circuit, which can lead to more power losses and BR. To avoid this conversion, we propose in this manuscript a configuration of a GC based on Si_3N_4 structures, which can be employed to minimize the footprint size and obtain better performance. The achievement of high efficiency was possibly obtained by optimizing the structural properties of the waveguide and the coupling angle from the SMF. The results demonstrated high efficiency within the O-band spectrum by using a wavelength of 1310 nm. Notably, at this specific wavelength, the findings indicated a coupling efficiency of −5.52 db. The proposed design of the GC consists of a uniform grating that offers improvements regarding affordability and simplicity in manufacturing compared to other GC models...

https://doi.org/10.3390/app13179951

Gap and Force Adjustment during Laser Beam Welding by Means of a Closed-Loop Control Utilizing Fixture-Integrated Sensors and Actuators

Authors: Klaus Schricker, Leander Schmidt, Hannes Friedmann and Jean Pierre Bergmann

Abstract: The development of adaptive and intelligent clamping devices allows for the reduction of rejects and defects based on weld discontinuities in laser-beam welding. The utilization of fixture-integrated sensors and actuators is a new approach, realizing adaptive clamping devices that enable in-process data acquisition and a time-dependent adjustment of process conditions and workpiece position by means of a closed-loop control. The present work focused on sensor and actuator integration for an adaptive clamping device utilized for laser-beam welding in a butt-joint configuration, in which the position and acting forces of the sheets to be welded can be adjusted during the process (studied welding speeds: 1 m/min, 5 m/min). Therefore, a novel clamping system was designed allowing for the integration of inductive probes and force cells for obtaining time-dependent data of the joint gap and resulting forces during welding due to the displacement of the sheets. A novel automation engineering concept allowed the communication between different sensors, actuators and the laser-beam welding setup based on an EtherCAT bus...

https://doi.org/10.3390/app13042744

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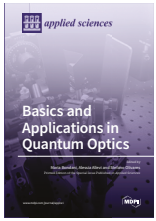
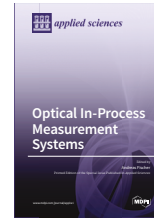
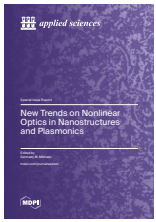


Basics and Applications in Quantum Optics



Optical In-Process Measurement Systems



New Trends on Nonlinear Optics in Nanostructures and Plasmonics

New Trends in Optical Networks

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Guest Editors: Dr. Francesco Enrichi et al.
Deadline: 20 February 2025

Topical Collection

Optical Design and Engineering

Collection Editors: Prof. Dr. Zhi-Ting Ye et al.

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