AUGUST 17-21, 2015

PROGRAM GUIDE

Hotel Real de Minas
Guanajuato, Guanajuato, México

INTERNATIONAL
YEAR OF LIGHT
2015

Organized by:

SEM

AMO

50 ANIVERSARIO

Table of Contents

Welcome

On behalf of Mexican Academy of Optics (Academia Mexicana de Óptica), AMO, the Optical Research Center (Centro de Investigaciones en Óptica), CIO, and Society for Experimental Mechanics, SEM, we would like to welcome you to the 5th International Symposium on Experimental Mechanics and the 9th Symposium on Optics in Industry, ISEM-SOI 2015, in Guanajuato, Guanajuato, Mexico.
Symposia coincide with the celebration of the International Year of Light 2015 and with the XXXV anniversary of the CIO. Hence ISEM-SOI 2015 are dedicated as part of these celebrations.

We would like to thank the participation pf eight distinguished plenary speakers whose abstracts are included at the beginning of the program guide.
A total of 111 papers were accepted through a review process and will be presented at the Symposia; out of these papers, fourteen were selected as invited.
Overall, papers were assigned to the following relevant tracks:

Dynamic and static structural and substructural testing, 39
Non-destructive methods, 54
Environmental measuring techniques, 4
Multi-scale metrology, 5
Advanced new materials and their characterization, 9

Technological offers were presented by the Instituto Nacional de Astrofísica, Óptica y Electrónica (INAOE); the Centro de Investigación Científica y de Educación Superior de Ensenada, B. C (CICESE); and the Centro de Investigaciones en Óptica (CIO). Two workshops will be offered: Color Management and Labview.

Participants of the ISEM-SOI 2015 came from around the globe and included 15 countries: 9 from Europe, 92 from the Americas, 9 from the Far East, and 1 from Africa.

We are happy and proud to have welcomed in Guanajuato well-known experts who came to discuss current and future challenges related to relevant topics in the tracks included in the program of the Symposia. Please enjoy the Symposia and the tranquility and peacefulness of Guanajuato. Thank you so much for participating!!

Amalia Martínez-García
ISEM-SOI 2015 General Chair
Centro de Investigaciones en Óptica, México

President
Academia Mexicana de Óptica

Cosme Furlong
ISEM-SOI 2015 General Co-Chair
Worcester Polytechnic Institute, USA

Introduction

Energy and the environment are inextricably linked. All energy production and consumption has environmental impacts. Whilst it is often tempting to overlook at the environment during difficult economic times, the challenges of producing and using energy resources sustainably and protecting our natural environment equally represent an opportunity to pursue sustainable economic growth.

Our modern society must address various severe problems to maintain and improve our quality of life: from water quality to global warming, to fossil fuel depletion, to environmental pollution. The process intensification strategy is expected to contribute to overcoming many of these issues by facilitating the transition from a resource-intensive to a knowledge-intensive industrial system that will guarantee sustainable growth.

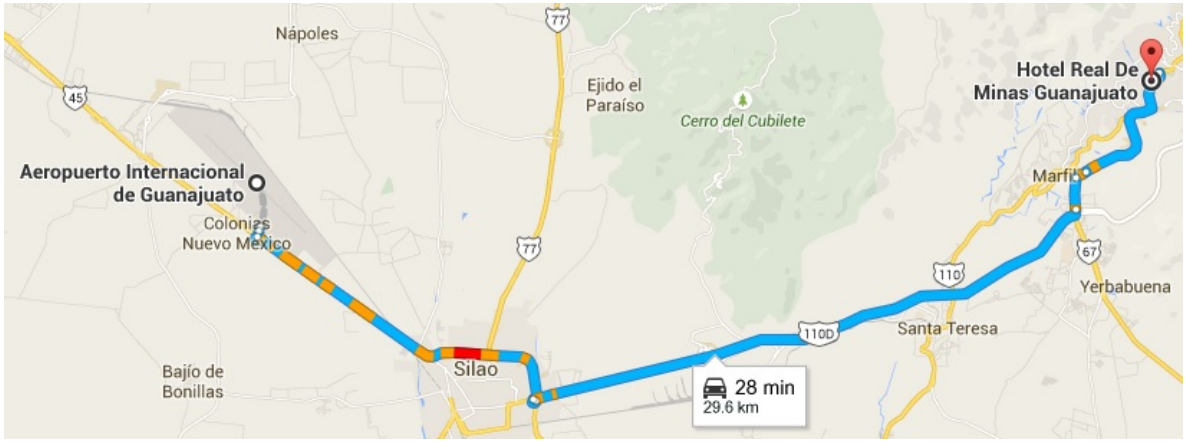
The 5th International Symposium on Experimental Mechanics (5-ISEM 2015) and the 9th Symposium on Optics in Industry (9-SOI), whose general topic is Emerging Challenges for Experimental Mechanics in Energy and Environmental Applications, organized by "Centro de Investigaciones en Óptica" (CIO) and the Mexican Academy for Optics (AMO), and under the sponsorship of the Society for Experimental Mechanics (SEM) and other national and international Organizations, are intended to be an interdisciplinary forum for engineers technicians, researchers and managers involved in all fields of Optics, Optomechatronics, Mechanics and Mechanical Engineering. The symposia will have recognized guest speakers of high level.

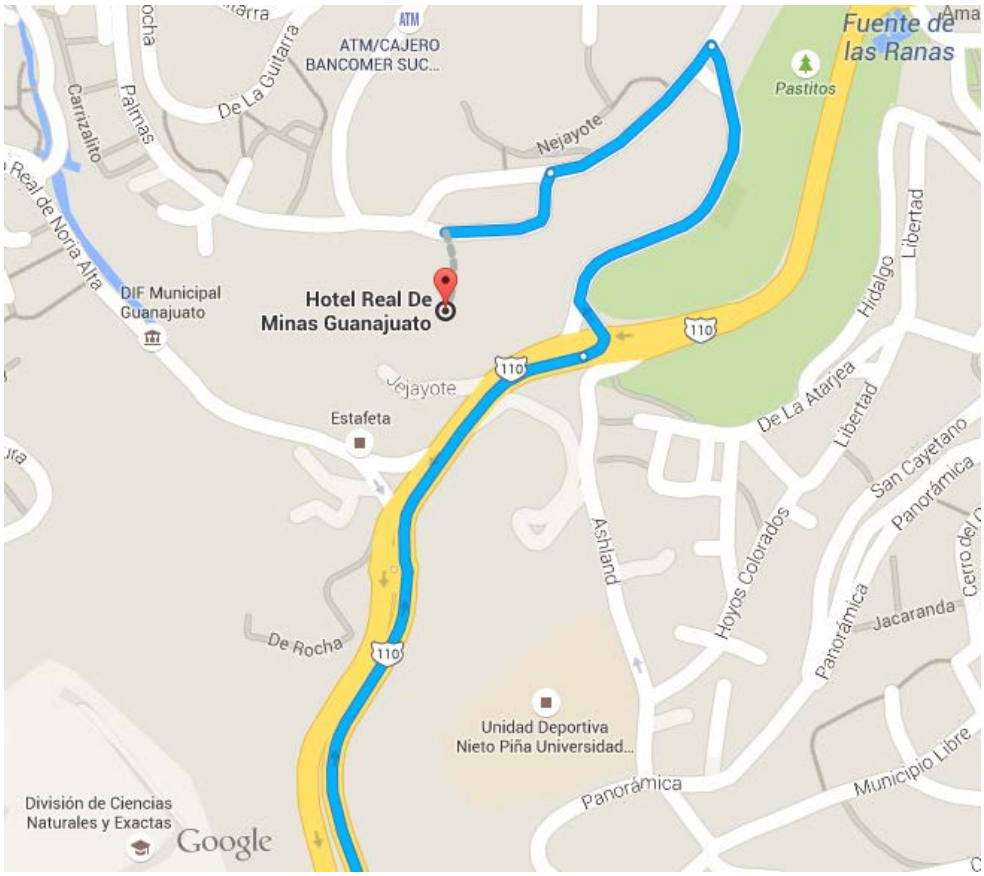
Venue

Symposia will take place at the Real de Minas Hotel, Guanajuato, Gto., Mexico.
Guanajuato, the capital of Mexico´s state of Guanajuato, is one of UNESCO World Heritage Sites and a charming colonial-era city situated in a picturesque valley surrounded by the mountains of the "Sierra de Guanajuato". The region is known as the "Bajío", the heartland of Mexico.

The city hosts the anual Cervantino Festival, a festival of performing arts that is named in honor of Miguel de Cervantes Saavedra, autor of Don Quixote, and statues of him and his sidekick, Sancho Panza, in the Allende Plaza just outside "Teatro Cervantes" (Cervantes Theater).

HOTEL REAL DE MINAS Guanajuato
Located: 29.6 km from Guanajuato International Airport
Address: Calle Nejayote #17, Guanajuato, Gto. CP. 36000, Mexico
Phone: (473) 7321460
www.hotelesrealdeminas.com.mx






Rooms Map
HOTEL REAL DE MINAS, GUANAJUATO
PARKING LOT
HUERTA
Room "Azul"
Room "Acacias"
Room "Antillon"
Room "Bugambilias"
Room "Princesa"
Room "Quijote"
Laundry
Room "Truco"
Maintenance
Room "Cata"
Accounting
"Magnolias"
Executive Office
Reception
Depot
Kitchen
Room "Valenciana"
WC
Restaurant "El Cantador"
Room Embajadoras"
Room "Las Torres"
CHAPEL
BBVA Bank
Bar
Business Center
Beauty Salon
Lobby
Hall
Hall
Parking Lot
Gift Shop
Tobacco Shop
Parking Lot
Bar
Terrace
WC
CARS
N
VALET PARKING
Terrace
ENTRANCE

Topics

Special emphasis will be given to topics related to the development and implementation of new experimental and hybrid methods for basic, applied, and innovation.
The program of the Symposia will include, but will not be limited to, the following areas:

Dynamic and static structural and substructural testing
Analytical-experimental methods
Computational modelling
Validation methods

Non-destructive methods
DIC
Holographic techniques
LIDAR
Moiré techniques and structured light methods
PIV & LDV
Speckle techniques
Ultrasound techniques
Others techniques

Environmental measuring techniques
Air quality
Clean technologies
Resource monitoring
Restoring nature´s balance
Undergroung resources

Multi-scale metrology
High-speed lasers
Macro-giga scale measurements
Microstructures
Pico-nano scale-measurements

Advanced new materials and their characterization
Biological and biomimetic materials
Composites & Multifunctional materials
Geo-materials
Low-impedance materials
Micro-and nano-structured materials
Self-healing materials
Time-dependent materials

Symposia Committees

Amalia Martínez-García, (AMO, CIO) México
General Chair

Cosme Furlong, (WPI) USA
General Co-Chair

Ramón Rodríguez-Vera, México
Honorific Chair

Ryszard J. Pryputniewicz, (WPI) USA
Program Chair

LOCAL ORGANIZING COMMITTEE

M. Torres-Cisneros, Universidad de Guanajuato, Mexico, Chair
J. Cruz-Mandujano, UMSNH, Mexico
E. De la Rosa-Cruz, CIO, Mexico
M. Hernández-Montes, CIO, Mexico
J. M. Lopez-Ramirez, ITESM, Campús León, Mexico
D. Malacara-Hernandez, CIO, Mexico
G. Ramos-Ortiz, CIO, Mexico
M. Rivera-Meraz, CIMAT, Mexico
A. Silva-Moreno, CIATEC, Mexico
G. Silva-Pineda, CENAM, Mexico

NATIONAL ORGANIZING COMMITTEE

B. Barrientos-García, CIO, Mexico, Chair
B. Ibarra-Escamilla, AMO and INAOE, Mexico
C. Meneses-Fabian, AMO and BUAP, Mexico
I. Torres-Gómez, AMO and CIO, Mexico
J. J. Alvarado-Gil, CINVESTAV, Mexico
R. Legarda-Saenz, UADY, Mexico
G. Rodríguez-Vilomara, CIDESI, Mexico
E. Rosas, CIO, Mexico
E. R. Méndez-Méndez, CICESE, Mexico

G. Rodríguez-Zurita, BUAP, Mexico

M. Strojnik, CIO, Mexico

A. Tellez, Instituto Tecnológico de Morelia, Mexico

C. Treviño-Palacios, INAOE, Mexico

J. B. Hurtado-Ramos, CICATA-IPN, México

H. Cerecedo-Nuñez, Universidad Autónoma Veracruzana, Mexico

O. Barbosa, CIO, Mexico

D. Tentori, CICESE, Mexico

E. Tepichín, INAOE, Mexico

INTERNATIONAL SCIENTIFIC COMMITTEE

F. Mendoza-Santoyo, CIO, Mexico, Chair

K. Zimmerman, Society for Experimental Mechanics, USA

A. Albertazzi Jr., Universidade Federal de Santa Catarina, Brazil

F. P. Chiang, Stony Brook University, USA

M. F. Costa, Universidade do Mihno, Portugal

R. Diaz, CCADET-UNAM, Mexico

J. Dirckx, Antwerp University, Belgium

M. Fujigaki, Wakayama University, Japan

E. Gdoutos, Democritus University of Thrace, Greece

K. Genovese, Università degli Studi dellaBasilicata, Italy

H. Jin, Sandia National Laboratories, USA

G. H. Kaufmann, Universidad de Rosario, Argentina

T. Kreis, BIAS- Bremer Institut für Angewandte Strahltechnik, Germany

M. Kujawinska, Warsaw University of Technology, Poland

L. Lamberti, Politecnico di Bari, Italy

I. Lira, Pontificia Universidad Católica, Chile

R. Cordero, Universidad de Santiago de Chile, Chile

Y. Lo, National Cheng Kung University, Taiwan

A. J. Moore, Heriot-Watt University, UK

J. J. Orteu, Ecole des Mines d'Albi, France

W. Osten, ITO- Univ. Stuttgart, Germany

C. Pappalettere, Politecnico di Bari, Italy

F. Pierron, University of Southampton, UK

J. A. Quiroga, Universidad Complutense de Madrid, Spain

P. Rastogi, EPFL- École Polytechnique Fédérale de Lausanne, Switzerland

C. A. Sciammarella, Illinois Institute of Technology, USA

M. Trivi, CIOp Centro de Investigaciones en Ópticas, Argentina
J. B. Vazquez-Dorrio, Universidad de Vigo, Spain
W. C. Wang, National Tsing Hua University, Taiwan
I. Yamaguchi, Toyo Seiki Seisaku-sho, Ltd, Japan
O. Yukitoshi, Center of Optical Research and Education, Japan

TECHNICAL COMMITTEE

Annette Torres-Toledo, Technical Secretary
Javier Omedes
Luis-Fernando González-Saldívar
Lucero Alvarado-Ramírez
José-Ignacio Diego-Manrique
Guadalupe López-Hernández
Elisa Villa-Martínez, Universidad de Guanajuato
Claudia Medina-Sánchez
Eleonor León-Torres
Guillermo Ramírez-Barajas

With the participation of SPIE-CIO Student Chapter.

Special Events

Sunday, August 16
Welcoming reception: 19:00-20:30
Terrace of Restaurant "El Cantador," hotel Real de Minas, by the side of the pool.
Please join your friends and colleagues during this informal reception. It will feature music, mariachi and beverages. It is open to all attendees.

Monday, August 17
Lunch: 13:30-15:00
Restaurant "El Cantador," hotel Real de Minas.

Callejoneada: 18:30-20:00
Meet at the Lobby of the hotel Real de Minas by no later than 18:00 to board the buses. The bus will leave at 18:15 and bring you to downtown Guanajuato where the event begins in front of the church of San Diego.
You can return to the hotel in the same bus or continue visiting the city.

"Callejoneadas"

"Callejoneadas" are a very nice tradition from the state of Guanajuato. First, participants gather up in one place, where women will be given a rose, and men a "purrón", which is a glass recipient containing a drink to enjoy as the group moves along. Then, the walk will start, and it is advisable to wear comfortable shoes that will go a long way.

The meeting point will be the church of San Diego, across the street from the Main Square ("Jardín Principal") where a "estudiantina" will be waiting for the group to start the walk.

A "estudiantina" is a band of young musicians dressed in gala clothes dating from the 16th century, who sing and play (mostly string instruments and accordions) as they walk, and whose job is to entertain participants in the tour with typical songs from the state of Guanajuato and Mexico, including current songs; they will get you to dance, sing and participate, and they will also tell you legends and funny stories from Guanajuato. One thing that is highly recommended is that while at "Callejon del Beso" (the Kissing Alley), you listen very carefully to the legend that the guides will narrate, for it is a sad but very nice story, and particularly full of magic.

Have you participated in a "callejoneada"? Wouldn't you like to go through the alleys of Guanajuato singing and listening to stories?
You are invited to "callejonear" !!

Tuesday, August 18
Gala Dinner: 19:00-
Place: Room ¨Valenciana,¨ Hotel Real de Minas
Join your colleagues for a festive evening featuring live music. The banquet is open to full technical attendees. Conference attendees may purchase extra tickets in advance for their guest.

Poster Session
Tuesday, August 18, 15:00-17:30
Room “Antillon”, Hotel Real de Minas

Poster presentations offer an effective way to comunicate new research findings and provide a venue for lively and detailed discussions between presenters and interested viewers. Do not miss this oportunity to discuss current research one-on-one with presenters.

ISEM-SOI 2015 Program at a glance
Hotel Real de Minas
August 17-21, 2015. Guanajuato, Guanajuato, Mexico

Sunday 16: Registration 13:00-18:00, Executive Office, Hotel Real de Minas, **and**
Welcoming reception: 19:00-20:30, Terrace of Restaurant "El Cantador," Hotel Real de Minas, by the side of the pool.

Time	Monday 17	Tuesday 18	Wednesday 19	Thursday 20	Friday 21
8:00-18:00	Registration (closed from 14:00-16:00)	Registration (closed from 14:00-16:00)	Registration (closed from 14:00-16:00)	Registration (closed from 14:00-16:00)	
8:30-9:00	Opening Ceremony				
9:00-10:00	**Plenary Talk Toyohiko Yatagai Room Antillon**	**Plenary Talk Pramod Rastogi Room Antillon**	**Plenary Talk Phillip Reu Room Antillon**	**Plenary Talk Jean-José Orteu Room Antillon**	Workshops: 1) Color Management 2) LabView (At the CIO)
10:10-12:00	Parallel Sessions: Invited Talks & Oral Contributions	Parallel Sessions: Invited Talks & Oral Contributions	Parallel Sessions: Invited Talks & Oral Contributions	Parallel Sessions: Invited Talks & Oral Contributions	
12:00-12:30	Exhibit Hall Opening and Coffee Break	Exhibit Hall Opening and Coffee Break	Exhibit Hall Opening and Coffee Break	Exhibit Hall Opening and Coffee Break	
12:30-13:30	**Plenary Talk Katia Genovese Room Antillon**	**Plenary Talk Manuel Filipe P. C. M. Costa Room Antillon**	**Plenary Talk Hubert Schreier Room Antillon**	**Plenary Talk Sofía Acosta Room Antillon**	
13:30-15:00	Photo and Lunch Restaurant Campanario	Lunch (on your own)	Lunch (on your own)	Technological offers: INAOE CIO CICESE	
15:00-17:30	Parallel Sessions: Invited Talks & Oral Contributions	Posters Session	Parallel Sessions: Invited Talks & Oral Contributions	Closing Ceremony	
17:30-18:30		AMO-SPIE meeting	SPIE Student Chapter meeting		
18:30-	Callejoneada organized by the Committee				
19:00-		Gala Dinner			

Plenary Talks: 45+15 minutes, Room Antillon
Invited Speakers: 25+5 minutes
Oral Contributions: 15+5 minutes

PLENARY SPEAKERS

Speaker Biography

Toyohiko Yatagai
Education
University of Tokyo: BE Applied Physics, 1969.
University of Tokyo: PhD Engineering, 1980.
Employment
Institute of Physical and Chemical Research, Researcher: 1970-1983.
University of Tsukuba, Associate Professor- Professor: 1983-2007.
Director of University Industrial Liaison Center Utsunomiya University, Professor: 2007-2012.
Director of Center for Optical Research and Education: 2007-date.
Awards
Optical Research Award, Japan Society of Applied Physics: 1983.
Fellow SPIE, OSA, JSAP
Visiting Professor: Xian Institute of Optics and Precision. Mechanics Chinese Institute of Metrology.
Appointment
President of Optical Society of Japan: 2009-2010.
Science Council of Japan, Associate member: 2005-date.
Chairman of Optical Industry Promotion Committee of Tochigi: 2009-date.
Vice-President of Japan Photonics Council: 2010-date.
SPIE Board of Directors: 2011-2012.
SPIE vice President, President elect: 2013-2014.
SPIE President: 2015
Papers:
More than 250 reviewed papers, and 10 Books

Abstract

Vector-Wave Holographic Memory: Challenge Again

Toyohiko Yatagai and Daisuke Barada
Center for Optical Research and Education
Utsunomiya University, Japan

In 1970s, it was the first phase of holographic optical memory technology, which had attentions by many researchers due to promising large capacity of data storage based on Fourier transform holography because large page data could be stored in small area. In the second phase in the first decade of 2000s, volume holographic techniques using photorefractive materials have been impressively demonstrated. Great growth of semiconductor and magnetic data storage technologies have carried away holographic techniques. We are now challenging again holographic data storage, in which new technologies will be introduced, such as vector wave recording, phase and amplitude encoded multiplexing etc. to develop 3 Tera Byte/5 inch disc. Optical data storage systems are energy-conserving and their life time is much larger than that of other systems.

Speaker Biography

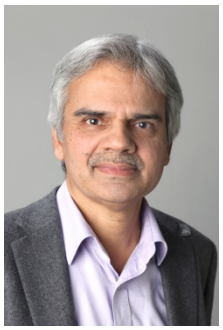
Katia Genovese obtained a Master's degree in Mechanical Engineering from Polytechnic of Bari (Italy), and a Ph.D. degree in Machine Design from University 'Federico II' (Naples, Italy) in 2002. She worked at Laser Research Centre (Bari, ITALY) and as visiting researcher at Nottingham University (UK), Union College (NY, USA), Centro de Investigaciones en Optica (Mexico), Ecole Nationale Supérieure des Mines (France), Texas A&M University (TX, USA) and Yale University (CT, USA). She is currently Associate Professor in Machine Design and head of the Experimental Mechanics Laboratory of the School of Engineering at University of Basilicata (Potenza, ITALY). Research areas concern optical methods for deformation analysis and their implementation within hybrid numerical/experimental approaches for the inverse mechanical characterization of materials. She is currently working in biomechanics where she developed novel experimental systems for the in vitro testing of biological structures.

Abstract

Multimodal Optical Measurement *in vitro* of Soft Biological Structures

Katia Genovese
School of Engineering, University of Basilicata, Potenza, Italy

Recent advances in mechanobiology reveal that many cell types try to offset complexities in geometry and applied loads with heterogeneous and anisotropic material properties in order to render their local environment mechanobiologically favourable, i.e., to promote a 'mechanical homeostasis'. Hence, whereas standard testing protocols in soft tissue biomechanics seek to simplify the data analysis by focusing on regions of homogeneity, the mechanobiology demands new methods that enable potentially heterogeneous material properties to be assessed, often given the native geometry of the tissue or organ.
In this talk, we will discuss the technical challenges associated with *in vitro* measurement of overall geometry, full-field surface deformation, and regional wall thickness of complex anatomical structures in their native configurations. In particular, we will present a recently developed Digital Image Correlation (DIC) based approach, which includes standard- and 360-deg DIC to track surface geometry and deformation of the aortic arch durign pressurization, and a Fringe Projection system to contour the heterogeneous distribution of the arterial wall thickness. Finally, to illustrate the potential utility of the dense set of experimental data obtainable with this approach, we will present the quantification of the regionally varying mechanical properties of a gallbladder using a membrane based point-wise inverse method to infer its full-field nonlinear behaviour under finite deformations.



Speaker Biography

Pramod Rastogi received his MTech degree from the Indian Institute of Technology Delhi, and doctorate degree from the University of Franche Comté in France. He started his research at the École Polytechnique Fédérale de Lausanne,
(EPFL) in Switzerland 1978. He is the author or coauthor of over 150 scientific papers published in peer-reviewed archival journals. He is also the author of Enciclopedia articles, and has edited several books in the field of optical metrology:

* Phase Estimation in Optical Interferometry, CRC Press, 2014.
* Optical Methods for Solid Mechanics: A Full-Field Approach, Wiley-VCH, 2012.
* Digital Speckle Pattern Interferometry and Related Techniques, John Wiley & Sons, 2001;
* Photomechanics, Springer-Verlag, 2000;
* Trends in Optical Non-Destructive Testing and Inspection, Elsevier, 2000;
* Optical Measurement Techniques and Applications, Artech Book House, 1998; and
* Holographic interferometry-Principles and Methods, Springer-Verlag, 1994

Professor Rastogi is the 2014 recipient of the SPIE Dennis Gabor Award. He is a Fellow of the Society of the Photo-Optical Instrumentation Engineers (1995) and a Fellow of the Optical Society of America (1993). He is also a recipient of the "HetÃ©nyi Award" for the most significant research paper published in Experimental Mechanics in the year 1982. Professor Rastogi is the co-editor-in-chief of the International journal of Optics and Lasers in Engineering, Elsevier.

Abstract

Multidimensional deformation measurements using holographic interferometry

Pramod Rastogi
École Polytechnique Fédérale de Lausanne, Switzerland

The applicability of the state-of-the-art optical methods for multi-dimensional deformation measurements is strongly limited by their reliance on sequential operations and complex experimental configurations. Hence, it is essential to develop vastly more targeted ways to address this issue. This has primarily lead to research focused on understanding and implementing processes needed for supporting information embedded in multi-wave interferometers. This talk presents an overview of estimation techniques based on spectral decomposition that have been proposed by the authors to address the problem, and summarizes various aspects based on accuracy and data frames.

Speaker Biography

Manuel Filipe Pereira da Cunha Martins Costa
Departamento de Física, Universidade do Minho, Campus de Gualtar, 4710-057 Braga, Portugal

Manuel F. M. Costa hold a PhD degree in Science (Physics) from the University of Minho (Portugal) were he works since 1985 at its Physics Department teaching and performing applied research in optical dimensional metrology, image processing, fiber optics, optometry, optical and optometric instrumentation, and on physics science and technology education and scientific literacy. Presented over three hundred invited, oral or poster communications in international meetings and published around the same number of scientific papers, monographs and books. He is editor or member of the editorial board of several scientific and educational international journals. He organised and acted as chairperson on eighteen international conferences and on over forty summer schools and workshops as well as European teacher training courses. Supervised nearly thirty master and PhD students in varied fields ranging from optical dimensional metrology and biomedical diagnosis to solgel and nanoparticles production and characterization or physics and science and technology teaching and learning. He organised and delivered countless outreach activities in different countries. He is member of the Scientific Advisory Board of the European Optical Society, member of the Board of the Iberoamerican Optics Network, RIAO, and member of the Board of Stakeholders of PHOTONICS'21. He act as president of the Hands-on Science Network, of the Portuguese Territorial Committee of the International Commission for Optics and of the Portuguese Society for Optics and Photonics, SPOF. He is member of the International Society for Optics and Photonics, SPIE and Fellow of European Optical Society.

Abstract

Non-invasive microtopographic inspection of rough surfaces by optical triangulation

Manuel F. M. Costa
Universidade do Minho, Centro de Física, Campus de Gualtar, 4710-057 Braga, Portugal

Non-invasive dimensional characterization of objects and surfaces is an issue of utmost importance in R&D and in a wide range of industries. Roughness characterization and the integral reproduction or inspection of the three dimensional structure of surface's relief is needed. In the industry the strict control of the production process requires an in-depth knowledge of the microtopographic characteristics of the surfaces of every material or parts used in all production phases. Most of the surfaces involved are optically rough in a range of diverse shapes and types: from hard stable, to soft ones with very little self-consistency; with random height distributions or clearly anisotropic; formed by just one component or conformed by regions made of different materials. Furthermore different types of inspection tasks must to be performed with higher or lower resolution and or dynamic range requirements, but always reliably and in a fast and inexpensive way. Optical triangulation in different approaches allow the establishment of metrological systems that by its inherent relative simplicity robustness and reliability can cope with most modern requirements of the non-invasive inspection of objects and surfaces both smooth or rough. In this communication we will present a brief review of the work done at the Microtopography Laboratory of the Physics Department of the University of Minho, Portugal, on the development of methods and systems of optical triangulation based microtopographic inspection of surfaces.

Speaker Biography

Phillip L. Reu is a Principal Member of Technical Staff at Sandia National Laboratories. He has obtained a Master´s degree in Biomedical engineering from Rensselaer Polytechnic Institute and Masters and PhD degrees from the University of Wisconsin at Madison in Mechanical Engineering. Since 2003 he has been working in the field of optical measurement techniques, specializing in the areas of Digital Image Correlation (DIC) and coherent laser measurements. Current research efforts in DIC are focused on uncertainty quantification. Phillip is the author of the "Art and Application of DIC" in the journal of Experimental Techniques, international instructor in DIC techniques for "Metrology beyond colors", and chair of the DIC Challenge. Other areas of active research include pulsed holography and electron Doppler velocimetry for nano-dynamics. His current job is full-scale testing at Sandia, where he is developing new techniques for large-scale and high-rate full-field measurements for application to explosively driven events.

Abstract

Quantifying errors in image based measurements

Phillip L. Reu
Sandia National Laboratories

Digital image correlation (DIC) is a powerful image-based measurement tool now widely used in experimental mechanics. The combination of ease-of-use, inexpensive equipment, and the power of the technique has led to its widespread adoption. This includes a number of commercial vendors selling turn-key systems down to home-grown university DIC codes. However, as DIC has moved from the university research lab out into national laboratories and industry around the world, it has become increasingly apparent that both training of DIC users and standardization of the methodology are critical. In many ways the progress has been similar to the adoption of FE, with many of the same problems: under-trained users producing questionable results. This presentation will survey the history and development of DIC and its use at Sandia National Laboratory, with a special emphasis on uncertainty quantification and best practices ideas.
Sandia is a multiprogram laboratory operated by Sandia Corporation, a Lockheed Martin Company, for the United States Department of Energy's National Nuclear Security Administration under contract No. DE-AC04-94AL85000.

Speaker Biography

Hubert W. Schreier received his Diplom der Vefahrenstechnik from the Universität Karlsruhe (Germany) in 1997. He then joined Prof. Michael A. Sutton's research group and received his Ph.D. in mechanical engineering in 2003 from the University of South Carolina where his research was focused on the quantification and reduction of bias in the digital image correlation method. He has published journal articles on a wide variety of topics covering the theory and application of the digital image correlation method and has recently co-authored a book on digital image correlation. Dr. Schreier is one of the co-founders and president of Correlated Solutions, Inc., a company that specializes in image correlation based measurement solutions.

Abstract

Volumetric Image Correlation

Hubert W. Schreier
Correlated Solutions, Inc., U. S. A.

The digital image correlation method has enjoyed growing popularity in the experimental mechanics community over the last decade due to its ease of use and high spatial and displacement resolution. However, using images acquired with optical cameras, the method is inherently limited to the measurement of displacements and strains on the surfaces of test objects. To overcome this limitation, researchers have extended the image correlation concept to volumetric image material that can be acquired, e.g., with CT-scanners. This approach permits direct measurement of the displacement vector field throughout the entire interior of a component. This presentation gives an overview of the volumetric image correlation method and the challenges in its implementation and application to real-world problems. A series of baseline experiments will be presented that demonstrate the typical bias in displacement and strain present in volumetric image data acquired with modern CT-scanners and a variety of application examples of the method will be shown.

Speaker Biography

Jean-José Orteu graduated in 1987 from a French "Grande Ecole" (ENSEIRB, Bordeaux, France) with an Engineering degree in Electrical and Software Engineering and a Master Thesis in Automatic Control. Working in the Robotics and Artificial Intelligence group of LAAS-CNRS (Toulouse, France) on the application of computer vision to the automation of cutting in mines, he received his PhD in Computer Vision in 1991 from Université Paul Sabatier (Toulouse, France). In 1992, he joined the Ecole des Mines d'Albi (Albi, France), a French "Grande Ecole" specialized in Process Engineering, as an Assistant Professor. From 1992 to 2000, he was head of the Electrical Engineering and Automatic Control department. He was promoted to the rank of Full Professor in 2002. From 2000 to 2007, he was head of the Dimensional and Thermal Optical Measurement group (17 people) dedicated to the development of non-contact methods for mechanical and thermal measurements in the field of material processing, for the study of the behaviour of materials and structures, and for process monitoring. Since 2008, he carries out his research work in the Institut Clément Ader (ICA) laboratory (220 people) and he is the Deputy Director of the ICA Albi Research Center (70 people). He is also head of the Institut Clément Ader's "Metrology, Identification, Control and Monitoring" group (30 people) which is dedicated to full-field mechanical and thermal measurements for experimental mechanics and process monitoring, identification from full-field measurements and NDT/NDE. His main interest topics are computer vision and automatic control and he is now more specifically involved in the application of computer vision to 3D metrology, photomechanics, process monitoring and NDT/NDE.

Abstract

Computer-vision-based NDE in aeronautics

Jean-José Orteu
Universite de Toulouse - Institut Clement Ader
Ecole des Mines d'Albi, France

Airplanes are periodically inspected, either on the airport tarmac between two fligths (preflight inspection) or in a hangar during maintenance operations. Today, these inspections are done by human operators, generally visually and sometimes with the help of some inspection tools (for instance to evaluate the criticality of a crack detected on the plane fuselage). In order to make the inspection more quick, more exhaustive and more accurate(and also for traceability reasons), a multi-partners research project is being carried on in order to develop a mobile robot equipped with several optical sensors (cameras and 3D scanners) to perform an automatic inspection of an airplane. This project will be presented.

Speaker Biography

Sofía Elizabeth Acosta Ortiz

She was born in the city of Aguascalientes, Mexico. She got her bachelor degree in Physics – Electronics (1982), the Master (1985) and the Doctorate (1988) degrees in Physics from the University of San Luis Potosi, Mexico. In 1991 she obtained a postdoctoral position focusing in Laser Physics in the University of Wales in Great Britain and in 1997 a research stay at the same university working on Raman Spectroscopy. In 2008 she got a MBA degree from the University of Liverpool, England.

Her areas of interest are the condensed matter, optical properties of semiconductors, spectroscopy and laser physics. She has published 36 articles in scientific magazines with international referee, 4 chapters of books published by international editorials and 27 articles in memories of national and international congresses. She has given 50 conferences in international congresses and 55 in national congresses. She has directed 18 research projects, 10 technological developments and 19 bachelor, mastery and doctorate theses.

She received the Weizmann Prize of Exact Sciences 1988 granted by the Mexican Academy of Sciences and the Weizmann Institute to the best doctoral thesis of the country and in 1999 she received a recognition by the University of San Luis Potosi for her "activities of academic leadership in the formation of new groups of work for the science of next millennium". She has received grants from CONACYT, the Economic European Community and the Royal Society of London. In 2011 she was awarded by the Association of Mexican Businesswoman with the prize “Women who transcend”.

She was a member of the Research National System (1988-2007) and since 1995 she is a member of the Mexican Academy of Sciences.

As for her professional experience, she has been a researcher of the Institute of Physics of the University of San Luis Potosi and of the Center of Research in Optics where she occupied in addition the charges of Head of the Group of Lasers and Optical Properties of Matter and Director of the Research Area. In 1996 she founded the Aguascalientes Unit of the Center of Research in Optics, which directed until July, 2000. In August of the same year she founded the Council of Science and Technology of the State of Aguascalientes where she was the General Director until June 2002.

In October 2002 she founded the company LASER TECH and in 2011 the Research Center in Applied Physics, that she directs up to date. In March this year, she received the 2014 National Prize for Technology and Innovation, granted to LASER TECH in the category of Technology Management, from the President of the Mexican Republic, Enrique Peña Nieto.

Applied Research for Technological Development and Innovation: a success case in Laser Tech

S. E. Acosta Ortiz
Laser Tech S. A. de C.V., Research Center in Applied Physics, Mexico

Mexican companies are betting for technological development and innovation as the best way for being successful. Proof of this is the fact that more than 60 companies have won the National Prize for Technology and Innovation since 1999 in the following categories: Technology Management, Product Innovation and Process Innovation. The success case of the company Laser Tech SA de CV, that won the 2014 National Prize for Technology and Innovation in the category of Technology Management is presented, along with its Model for Technology Management and the technological developments designed and built to date.
Laser Tech challenges and how it has managed to overcome them are also presented.
Laser Tech was founded in October 2002 with the initial purpose of offering laser cutting and engraving services to local industry. With time the market needs made the company extended its services, offering now the design and construction of customized laser systems, according to the specific needs of each industry. Laser Tech also offers technological consultancy for the installation of laser systems in production line and specialized courses in Lasers, Electronics, Physics and Technological Business Administration.

Technological offers

INAOE´s technological vision

David Sánchez de la Llave
Coordinación de Óptica, Instituto Nacional de Astrofísica, Óptica y Electrónica
Tonantzintla, Pue. México

A fundamental part of INAOE´s mission is the generation, advancement and dissemination of knowledge for Mexico´s development. This is realized through the identification of solutions to scientific and technological problems as well as through forming highly trained human resources. The vision of the institute is to achieve excellence in its competence areas with a high commitment to Mexico´s development.
To fulfil these requirements, basic research and student training is conducted in our Research and Service Laboratories in order to find novel solutions applicable to technological development.
As concrete examples of this effort we have an EMA (Mexican Accreditation Unit) certified laboratory in colorimetric magnitudes, which are employed in textile and automotive industries. We also have the second largest coordinate measuring machine in the world. It has the capability of measuring 6.1 x 4.2 x 3.4 meter objects (wide x length x height) with 80 microns accuracy. There is also the possibility of polishing large aspheric surfaces up to 5 meter in diameter. Additionally, we possess one of the few optical shops in Mexico, mainly devoted to the construction of high quality optical elements.
At INAOE, signal and image processing is also possible for scientific, industrial and medical applications. Signal acquisition is realized through commercial and homemade electronic and optoelectronic systems which allow local competence research areas, such as robotics or data mining, to have customized optical data to process. This expertise allows us to build full size simulators for helicopters or interceptor crafts, with real-time feedback.
Therefore, INAOE´s technological vision is to bring basic research expertise to concrete technological solutions in areas like large volume metrology, national security, biomedicine, or color industry.

Optics in Industry

Gonzalo Páez Padilla
Dirección de Tecnología e Innovación, Centro de Investigaciones en Óptica
León, Gto. México

Science has changed everything in mankind lifestyle. We can discover and understand nature with science, and with technology we can apply that knowledge in order to improve processes and efficiency.
Optical sciences and optical technology have been playing a very important role for the last 500 hundred years, from telescopes and microscopes to smartphones and medical diagnosis devices. As we have better understanding of generation, propagation and detection of light we create better ways to control visible and invisible light waves.
Light has very high importance in our daily lives, from very fundamental nature processes like photosynthesis to the engraving of sub-micrometric patrons on semiconductors.
We have new approaches with optics to use alternative energy sources, and with optics we have been capable to connect our world. Optics has generated a very big industry and abundance of technology-based businesses. Economic impact of such businesses is about three hundred billion dollars and an expected year 2020 growth to six hundred billion dollars.

The main optics segments experimenting global market growing are medical technology and life sciences, safety and defense technology, light sources, information technology, communication technology, optical systems, photovoltaic, machine vision and of course displays.
Optics has among the leading industrial fields of application food production, natural resources exploration, quality control in vehicle production, textile manufacturing, aerospace and aeronautical industry, entertainment and broadcasting, social networking and energy supply.
Optic-based businesses generate some of the better-paid jobs. According to a 2014 survey from SPIE the median salary of respondents is seventy three thousand dollars, and 85% of survey respondents enjoy their work and 88% respect the work of the peers.
Now days, using techniques like spectroscopy, optical design, interferometry, laser applications, ultrafast optics, digital image processing among others, the optical industry has brought the electronic book to our hands, LED lighting, novel medical image diagnosis, minimum invasive surgery, innovative organic solar cells, cutting-edge homeland security tools, and naturally has lowered manufacturing costs of myriad of supplies.
So science has given us the knowledge to conceive through technology, creative and innovative solutions, and optical sciences and optical technology has become a core in the improvement of our lives creating multibillionaire industry and a large amount of unthinkable future opportunities.

Technology capabilities at the Department of Optics in CICESE

Santiago Camacho-Lopez
Departamento de Óptica, Centro de Investigación Científica y de Educación Superior de Ensenada, B. C.
Carretera Ensenada-Tijuana 3918, Zona Playitas, Ensenada, Baja California, 22860. México

The Department of Optics at CICESE is composed by internationally recognized research groups in the following topics: Nonlinear Optics, Quantum Optics, Lasers, Laser processing of materials, Biophotonics, Nanophotonics and Plasmonics, Nonlinear microscopy, Fibers and waveguides, Integrated optics, Scattering, Image processing. Within these topics we have developed technological applications on diverse areas such as laser medical applications, fiber based sensors, microfluidics, laser microprocessing of materials, optical studies of polymers and paints, laser based fabrication of metallic nanoparticles and quantum dots, nonlinear optical microcopy for the biological and medical studies, microRaman spectroscopy for the study of industrial materials. Our Department counts with modern scanning electron microscope (SEM) facilities, which includes energy dispersive spectroscopy (EDS) and nanofabrication (NanoMaker) tools. Our infrastructure also includes a large Raman system and UV-VIS spectroscopy for structural and optical analysis of a wide variety of materials and media. 3-D printers are also part of the recent Department acquisitions which make our technological output even more diverse.
Current technological and innovation collaborations include partners like COMEX, IMP, Clinica de Ojos de Tijuana and Oftalmica International. We are open to new enterprises, being an experienced Department of Optics, we have knowledge we are ready to share to develop new technology and make a step forward in innovation.

Stands

Visit the ISEM-SOI2015 Exhibit Hall at the Room Azul and get a glimpse of the latest optical innovations! The exhibit floor will feature companies representing a broad range of the best products and applications in the optics and photonics industry. Don't miss this opportunity to learn about new products, find technical and business solutions and gain the most up-to-date market perspective of your industry.

CENTRO DE INVESTIGACIONES EN OPTICA, A.C.

Loma del Bosque 115, Col Lomas del Campestre
León, Guanajuato, México
P. +52 (477) 441 42 00
URL: www.cio.mx
Email: maestria@cio.mx
doctorado@cio.mx
anamoran@cio.mx

CIO develops applied and basic research for contributing to the generation of knowledge and innovation in the photonics and optics fields, to strengthen the technological leadership of México and promote the formation of new enterprises based on the scientific knowledge. To offer the best post graduate studies in optics and photonics and contribute to the development of a scientific and technological culture in our society.

INAOE

P. +52 (222) 266 3100
URL: www.inaoep.mx
Email: direcciondeinvestigacion@inaoep.mx

INAOE is a Public Research Center, dependent on the Mexican Federal Government through the National Council for Science and Technology, CONACyT. Its research areas are focused on Astrophysics, Optics, Electronics, Computer Science and related fields. INAOE offers graduate programs in the fields of Astrophysics, Optics, Electronics, Computer Science and Space Science and Technology. It was founded in 1971.

SATEL SA MR

URL: www.satelsa.com.mx
Email: satelsa@satelsa.com.mx

Satelsa is a company that sells I&D equipment to research institutes, industry and universities. We supply equipment to work in the field of physics, chemistry, biology, research materials, applied sciences and others. Also we provide tech support and consultant advice for the equipment we sell and for tech applications related to them.

Correlated Solutions, Inc.
121 Dutchman Blvd.
Irmo, SC 29063, USA
Tel: (803) 926-7272
URL: http://www.correlatedsolutions.com/

Correlated Solutions offers non-contact shape and deformation measurementsolutions for materials and product testing. These measurements can be made on length scales ranging from microns to meters and time scales as small as nanoseconds. Our scientists and engineers have specialized in deformation measurements for over 20 years and are recognized as world leaders and the inventors of Digital Image Correlation. In addition to our powerful Digital Image Correlation systems, Correlated Solutions also offers a range of measurement solutions for Laser Shearography and Vibration analysis.

+52 (222) 2 29 5500, ext.5084
URL: http://www.buap.mx/
Email: admision@correo.buap.mx

BUAP offers multiple undergraduate careers; also offers its high schools and various disciplines in education via the Internet (online); as well as various postgraduate (masters and doctorates).

CCADET
URL: http://www.ccadet.unam.mx/
The Centro de Ciencias Aplicadas y Desarrollo Tecnológico (CCADET) is an academic center at UNAM dedicated to the research, technological development, human resources training, and dissemination of the knowledge in the fields of scientific instrumentation, micro and nanotechnology, information technology and teaching in science and technology. It offers graduate studies on Electric and Mechanical Engineering, Physics, Computing and Musical Technology.

The University of Guanajuato's educational tradition established in 1732 and through 280 years of existence has created numerous contributions to knowledge improvement both to the state and the country. We are proud of the soundness of this tradition, but most of all, for providing strength, stimulus and examples to elaborate contributions that our generation requires for the present and future research and economic development of Guanajuato and Mexico.
With the aim of becoming a world class university, currently the University of Guanajuato offers 182 academic programs, including 19 doctorates, 38 master's degrees, 26 graduate specializations and 96 licenciate/bachelor's degrees; it is also ranked second in research among the state universities in Mexico with 397 researchers who have been recognized by the National System of Researchers of the Mexican Council of Science and Technology (CONACyT) and has invested in research facilities that are unique nor only to the region, but also at the national level such as Guanajuato Techno Park,

Mexican Center for Renewable Energies, the National Laboratory for Characterization of Molecular Structures and the Guanajuato International Robotic Spectroscopic Telescope “TIGRE”.
Research is conducted in academic groups creating and ideal environment for knowledge production, management and transfer. More than 80 research groups work in areas such as arts, economic and administrative sciences, engineering, health sciences, social sciences and humanities. Backed in this awareness of self-responsibility, in 2010, our community created and approved the Institutional Development Plan for 2010-2020 where numerous proposals were gathered by students, professors, administrative personnel, society representatives as well as experts in planning and educational management and other sectors.
For further information, visit our web page http://www.ugto.mx/.
“The truth will set us free”

Aló Arará
Yaquis No. 164, Colonia Tlalcoligia, Tlalpan D. F. C. P. 14430. México
Julio Antonio Contreras Julián
+52 (735) 35 6 48 75
Email: imagen_matiz@yahoo.com
Facebook: IMAGEN:MATIZ

Imagen Matiz have been working for 30 years providing Image and design services for Industry, Educational Institutions, Professionals and Scientists Societies, first of all in Congresses and Conventions, our services include, photograph, video, awards, pins, stands, and now we are developing two design lines based on pre columbian and contemporary art, interacting with lapidarius , artisans from all over the country, bringing textiles, leathers, and some other kind of cultural handicrafts to your jewelry in silver and natural stones.

LORETA Studio
URL: www.loreta.com.mx
Address : Cerrada Mineral de Valenciana 12, Marfil, Guanajuato, Gto 36250, MEXICO
+052 473 7334894 or 473 100 6181 cell
PLASTIC ARTIST: original paintings in different techniques as:
Pastel, Gouche, Acrilic, Oil and Murals.
The style is figurative and subrealistic.
Accesible prices.
My paintings are all over the world.

Vianala León
URL: http://www.vianala.com/handbags-manufacture-mexico/
Address: Camécuaro #318B, Col. La Brisa, León, Gto. 37240
+52 (477) 7133305
We manufacture leather goods since 1979 in León, Gto. México
Our products:

- Leather handbags, wallets, briefcases, messenger bags, laptopcases.
- Accesories: passport holders, card holder.
- Corporate gifts: desk pad set, notepad holder.

ISEM-SOI 2015
Program in Detail

Monday, August 17, 2015

8:30-9:00 Opening Ceremony **Room Antillon**

9:00-10:00 Plenary Conference **Room Antillon**

Conference Chair: Cosme Furlong, Worcester Polytechnic Institute, USA
Co-Chair: Amalia Martínez-García, Centro de Investigaciones en Óptica, México

Vector-Wave Holographic Memory: Challenge Again
Toyohiko Yatagai and Daisuke Barada,
Center for Optical Research and Education, Utsunomiya University, Japan

10:10-12:00 Non-destructive methods Room Antillon

Session Chair: Cosme Furlong, Worcester Polytechnic Institute, USA
Co-Chair: Noé Alcala-Ochoa, Centro de Investigaciones en Óptica, México

1.1 10:10-10:40
(Invited talk) Residual Stresses Measurement by The Hole-Drilling Technique and DSPI using the Integral Method withDisplacement Coefficients
A. Albertazzi Jr., Filipe Zanini, M. R. Viotti, C. L. N. Veiga
Universidade Federal de Santa Catarina, Brazil

The authors developed a portable optical residual stresses measurement device that combines the incremental hole drilling method with digital speckle pattern interferometry in polar coordinates The device is able to measure in plane radial displacement components around the drilled hole A set of normalized radial displacement vectors were computed by the Finite Element Method for each hole depth increment according with the integral method [1]. The radial displacement field around the drilled hole is optically measured and processed to extract the zero order and second order harmonics and fitted by least squares to the coefficient vectors to quantify the amount of residual stresses in each material layer The residual stresses profile is then determined for every 0 05 mm A controlled experiment using a bent plate is used to experimentally evaluate the measurement performance of the developed approach The results uncertainty are comparable to the strain gauge measurements The total measurement time is about 30 % of the time required for strain gauge measurements. [1] G S Schajer " Measurement of Non Uniform Residual Stresses Using the Hole Drilling Method Part I - Stress Calculation Procedures ", J Eng Mater Technol 1988 110 (4)

1.2 10:40-11:00
Quantification of slow mechanical displacements in metal samples by optical polarization phase shift DSPI
Darwin Mayorga Cruz, José A. Marbán Salgado, Víctor M.

10:10-12:00 Dynamic and static structure and substructure testing Room Princesa

Session Chair: Amalia Martínez-García, Centro de Investigaciones en Óptica, México
Co-Chair: Bernardino Barrientos-García, Centro de Investigaciones en Óptica, México

2.1 10:10-10:40
(Invited talk) Controlling Bounce of Vacuum Circuit Breakers´Contacts
Masao Narita[1], Naoki Yaegashi[1], Minoru Kobayashi[2], Shigeru Inaba[2]
[1]Mitsubishi Electric Corporation, Advanced Technology R and D Center, Japan
[2]Mitsubishi Electric Corporation, Power Distribution Systems Center, Japan

In the process of closing of three-phase vacuum circuit breakers (VCB), the collisions between the contacts in the vacuum tubes cause bounces of the contacts themselves. Consequently, repetition of make and break happens. If the duration of this phenomenon exceeds a certain time length, the surfaces of the contacts are damaged by heat of the arcs appeared among the contacts. This causes the deterioration of the intrinsic functions of the VCB. The paper presents an experimental process to solve this problem by using a 10kV 40kA VCB as an example. The disconnection of the contacts occurs when the magnitude of the reaction forces between the contacts falls below a certain level. Therefore, firstly, the time functions of the reaction forces were estimated by using the structural frequency response functions and the vibration responses measured in the closing process. Secondly, the duration was derived by evaluating these force functions. Finally, a method for structural modification to decrease the duration was proposed.

2.2 10:40-11:00
An integrated approach for the improvement of dynamic characteristics of ventilation
Bishnu Pad Pal, K. Ramakrishn, G. Jayaraman
Corporate Research & Development Division, BHEL, India

Juárez Núñez, Álvaro Zamudio Lara
Center for Engineering and Applied Sciences (CIICAp),
Autonomous University of the State of Morelos, Mexico

In this work the optical polarization method applied on phase shift digital speckle interferometry (PSDSPI), was performed for measurement of slow, small mechanical out-of-plane induced displacements. A basic experimental setup was used to obtain digital specklegrams related to mechanical displacements during specific time intervals. A digital image processing computational analysis was applied on experimental data, combined with analysis of phase shift positions generated by a polarizer and as a result a reliable measurement of displacements was obtained. Although conventional piezoelectric phase shifting methods are well established, the optical polarization method still preserves advantages as less complex instrumentation and low cost implementation is needed.

1.3 11:00-11:20
Temperature measurement of a synthetic jet produced by a Helmholtz cavity
A. Blanco[1], B. Barrientos[1], A. Moore[2], C. Mares[1]
[1]Centro de Investigaciones en Optica A. C., Mexico
[2]Heriot-Watt University, United Kingdom

Preliminary results are presented of the measurement of temperature distribution fields of a synthetic jet produced by a Helmholtz resonant cavity when used for the cooling of an aluminum plate. The plate is set at different temperatures and background-oriented schlieren images are registered by a high speed camera at 2000 fps. The background consists of sinusoidal fringes printed on a transparent slide and back -illuminated by a matrix of 20 3-W white LEDs. A reference image is taken with no jet and a series of images are then recorded with the cavity working in the first resonance frequency, 140 Hz. The observation region corresponds to an area of 1x10 cm2. Results show an oscillatory behavior of the temperature distribution at the resonant frequency.

1.4 11:20-11:40
Instrument for recording Purkinje images
Cosme Cisneros, G. A. Escamilla-Ruiz, D. Flores Montoya, G. Hernández-Gómez, A. Gómez-Vieyra
Universidad Autónoma Metropolitana, México

Purkinje images are images generated by the reflection of light at different interfaces of the ocular reflective surfaces. The study of the Purkinje images is interesting to determine changes in the alignment of those surfaces. An optoelectronic system capable of generating and detecting Purkinje images in a patient is presented. A symmetric near-infrared illumination array is used to relate the position and orientation of the images obtained with misalignment in the optical axes of the eye. Besides, the images are processed to identify each of the Purkinje images using multi-thresholding.

1.5 11:40-12:00
Development of a portable three-dimensional measurement system using stereo vision and optical flow algorithms
G. Parra-Escamilla, Y. Otani
Utsunomiya University, Japan

In this work we combine optical flow and stereo vision algorithms, for obtaining a three dimensional object tracking system capable to follow changes varying in time. The optical flow algorithm allows us to study time-varying

Ventilation fan constitutes one of the critical components of traction motor. As the weight of the component is to be kept minimum, it is made up of aluminium alloy casting. But it has to withstand high centrifugal acceleration and shock loads. Any failure of the fan shall lead to consequential damages to the motor resulting in long outages and huge expenditure. This paper presents an integrated approach with an improved quality plan to meet the operational criteria of the fan. It consists of a review of all the aspects like design analysis, material composition, casting process and control, heat treatment, post casting operations, aerodynamic and mechanical performance testing in a specially built test rig followed by field trials, which resulted in achieving a longer and trouble free performance.

2.3 11:00-11:20
Analytical and experimental evaluation of spring back effects in a typical cold rolled
Bishnu Pad Pal, D. Ramamohan Rao
Corporate Research & Development Division, BHEL, India

Prediction of spring back for forming of a typical shape of Cold Rolled steel sheet has been carried out using FEM. The objective of this work is to predict the spring back in the form of a typical shape of cold rolled steel sheet and compare that with the actual spring back as occurs in experiment. A typical shape is designed using AutoCAD and Solidworks. Die and punch to form the shape has been designed using 2d and 3d modelling tools. The Finite element simulation is done considering the material and geometric nonlinearity. Non-linear material properties are obtained from the tensile testing of the standard test specimen made from the same material and of same thickness. Geometric nonlinearity is considered by selecting appropriate option in the FEM package. Die, punch and sheet are considered in the finite element analysis. Final deformed shape after occurrence of spring back has been obtained in the finite element analysis. Die, punch and sheet is made for model blade and forming operation is carried out using hydraulic press. Spring back obtained in the actual forming of the sheet is measured and compared with the FE analysis results which are in line with each other.

2.4 11:20-11:40
Comparative analysis of optoelectronic properties of glucose for non-invasive monitoring
J. García-Guzmán, N. González-Viveros, H. Cerecedo-Núñez
Universidad Veracruzana, México

Among the diversity of methods for glucose level monitoring in human blood, invasive techniques are still the most commonly used. Blood samples, usually obtained with finger-pricking devices, are analysed through enzymatic reactions via electrochemical or photometric principles. In this paper, non-invasive methods for blood glucose monitoring are studied and compared, and also analysing optical and electronic properties of glucose. From this comparative analysis, proposals are made towards the design and characterisation of novel devices capable of monitoring blood- glucose levels through optoelectronic non- invasive procedures. Alteration of electrical parameters of cellular membrane, such as electric permittivity and conductivity as a function of blood glucose concentration, are observed and compared to the responses to optical stimuli. The investigation is developed by establishing a correlation between the effects of diffusion and dispersion of light on the concentration and dispersity of blood particles,

displacements and by using a stereo vision system we can retrieve the coordinates of the objects observed in the three axes (x, y, z) and therefore the reconstruction of such objects. A stereo vision system was implemented in Matlab using two identical webcams placed in parallel geometry. The ultimate goal of this project is to have a portable and affordable system that takes into account the intrinsic disadvantages of the method such as limited resolution and distortion produced by the webcams. Experimental results and system limitation analysis are presented. Also we present preliminary results at the NIR region.

and the response of electrical parameters under different glucose concentrations. As a result of the analysis, recommendations are made for the most suitable parameters and instrumental methodology, in terms of feasibility, easiness and precision, for non-invasive monitoring of blood glucose levels.

2.5 11:40-12:00
Identification of microorganisms using digital holographic microscopy
S. Muñoz, M. S. Hernández, F. Mendoza
Centro de Investigaciones en Óptica A. C., México

The recognition of microorganisms is important in the diagnosing of the micro-biology. In the medical field the cell disorders can affect body tissues indirectly. In this work we use digital holographic microscopy (DHM) that can achieve high contrast images. This method permits us to obtain phase maps by means of digital reconstruction of the wavefront produced. The phase differences allow us to realize quantitative and qualitative analyses of the sample. An off-ax is arrangement is used to determine the morphology and identify the predominance of different kind of microorganisms. The direct examination of aggregations obtained from the phase maps can be done as well. The images provide information about the presence of microorganisms that can be used as indicators of the physiological state of the body. DHM opens up new perspectives within biomedical applications.

12:00-12:30 Exhibit hall opening and coffee break

12:30-13:30 Plenary Conference **Room Antillon**

Conference Chair: K. Falaggis, Warsaw University of Technology, Poland
Co-Chair: Rosario Porras-Aguilar, Instituto Nacional de Astrofísica, Óptica y Electrónica, México

Multimodal Optical Measurement *in vitro* of Soft Biological Structures
Katia Genovese
School of Engineering, University of Basilicata, Potenza, Italy

13:30-15:00 Photo and Lunch **Restaurant Cantador**

15:00-17:30 Non-destructive methods Room Antillon

Session Chair: Toyohiko Yatagai, Utsunomiya University, Japan
Co-Chair: Cruz Meneses-Fabian, Benemérita Universidad Autónoma de Puebla, México

1.6 15:00-15:30
(Invited talk) Measurement of sub-surface stresses using THz radiation
P. Schemmel, G. Diederich, A. J. Moore
Heriot-Watt University, United Kingdom

Recent advances in THz sources, detectors and components make it possible to conduct stress measurements on a range of plastics and ceramics that are

15:00-17:30 Dynamic and static structure and substructure testing Room Princesa

Session Chair: Katia Genovese, University of Basilicata, Italy
Co-Chair: María del Socorro Hernández-Montes, Centro de Investigaciones en Óptica, México

2.6 15:00-15:30
(Invited talk) Experimental and Numerical Investigation of Effects of Fiber Orientation of Wood Stiffness
T. Y. Kuo, W. C. Wang
National Tsing Hua University, Republic of China

Wood is one of the most useful and important natural materials with diverse applications in civil, architectural and constructional engineering. The stiffness of the Wood

transparent at THz frequencies but that are opaque at visible wavelengths. To demonstrate this, measurements of the relative stress optic coefficient for teflon, polypropylene and polyethylene between 0.26 and 0.40 THz are reported. The stress measurements are similar to traditional photoelasticity, but tests can be performed directly on the actual components of interest in high value manufacturing, rather than on a model of the component that is transparent at visible wavelengths.

1.7 15:30-15:50
Digital Image Correlation in the Microstructural Scale
F. A. García Pastor
Cinvestav Unidad Saltillo, Mexico

Digital image correlation (DIC) is an optical technique widely used to carry out non-contact strain measurements. This technique may be extended to the microstructural scale in order to analyze heterogeneous strains due to crystallographic orientations or the presence of second phases in the microstructure. In this paper, the results of the application of this technique to two different sets of specimens are presented. An experimental setup consisting of micro-tensile tester stage attached to an optical microscope was used to deform tensile samples of Al1100 and Al6061, two common aluminum-based alloys. The specimens were deformed while optical micrographs were taken at several stress levels. The images were analyzed using specialized DIC software. The results are discussed in terms of the strain differences between single-phase and secondary-phase reinforced alloys. Several other research routes for this technique are also suggested.

1.8 15:50-16:10
A self-calibrating phase-shifting algorithm base on fitting ellipses and the Euclidean distance
F. A. Lara-Cortés, C. Meneses-Fabián
Facultad de Ciencias Físico-Matemáticas, Benemérita Universidad Autónoma de Puebla, México

The main idea of this work is to present a new method for reconstructing the desired phase without the use of the tangent function, which is widely used in the great majority of the phase shifting algorithms (PSA). As a first step we start adjusting intensity profiles to the parametric equation of an ellipse by using least squares, the second step is to extract the information from phase to measure the Euclidean distance between points formed by the intensity profiles to the ellipse fitting, named as the Euclidean Distance Method (ED). Under experimental conditions, the background and modulation light can present smooth variations. We show that the ED method is better than (PSA) techniques that use the tangent function. This work shows numerical simulations and experimental results.

1.9 16:10-16:30
Unfolding Phase Wrapping
C. G. Treviño-Palacios
Instituto Nacional de Astrofísica, Óptica y Electrónica, México

In most nondestructive optical measuring techniques (interferometry, Moire, speckle, holography, etc.) the final step in the phase map extraction process is the reconstruction from the principal branch wrapped phase map. This procedure, known as phase unwrapping, normally explores the continuity of the phase map by removing the discontinuities using either path- following or minimum-norm methods. Here we present a different

depends on the fiber orientation, distribution of knot and percentage of latewood, etc. Japanese cedar (Cryptomeria japonica) was used to prepare the tensile test specimen in this paper to investigate the effects of fiber orientation on wood stiffness. Before performing the tensile test, surface image of the test specimen was captured and the image was analyzed by least squares method and digital image processing software of MATLAB to obtain the fiber orientation. Based on the obtained fiber orientation, finite element method (FEM) software package ANASYS was employed to calculate the strain distribution of the test specimen. Three-dimensional digital image correlation (3D DIC) method was also used to verify the FEM results. The DIC software, VIC-3D, was used to analyze the surface deformation of the test specimen under tension. Strain distribution differences between the earlywood and latewood were investigated. With the integration of the digital image analysis technique, FEM and 3D-DIC method, the effective stiffness of the wood can be predicted and the reliability and safety of wood construction can be ensured.

2.7 15:30-15:50
A microflow injection procedure fase on automated hydrodynamic system for spectrophotometric determination of cobalt
Rosa Camarillo Escobedo[1], José Alfredo Padilla Medina[2], Jorge Alberto García Muñoz[2], Ricardo Rodríguez Rivera[1], César Adrian Ocon Diaz[1], Christian Reyes Córdoba[1]
[1]Instituto Tecnológico de la Laguna, [2]Instituto Tecnológico de Celaya, México

The development of analytical systems has been focused on two aspects, first on the design of large versatile and robust equipment where operation is performed in a controlled laboratory, second, on miniaturization and automation of analytical systems that can be used in the place where the sample is taken and generate results in real time. In this work, an automated hydrodynamic system was implemented with miniaturized actuators to provide a microflow injection and auto-calibration. The microflow injection procedure was operated by implementing the multicommutation technique for handling solutions. The auto-calibration was operated by a virtual instrument allowing the response control process in real time. Automated microflow injection was developed to perform calibration. The auto-calibration process, the precision and accuracy of the hydrodynamic system was evaluated by spectrophotometric determination of cobalt concentration. A linear response was observed from 0.1 to 3.0 mg/L-1. The result was validated by a commercial instrument.

2.8 15:50-16:10
Development of a presure cell to characterize flexible bio-films
O. G. Zamora-López[1], J. A. Huerta-Ruelas[1], A. Moreno Baez[2], A. Hernández-Zavala[1]
[1]CICATA, [2]Universidad Autónoma de Zacatecas, Mexico

The development of bio-films as packaging materials is an important issue in the environment preservation since bio-films are made of renewable materials and are biologically degradable compared to conventional polymers. Current studies involve the usage of starch, protein, polysaccharides and other biopolymers, for film production. An important issue in the bio-film studies is to characterize its mechanical and structural properties. This work focuses in the design and construction of a cell prototype with pressure controlled which is applied to evaluate film properties. Pressure range is up to 30psi. Prototype design considered different sample

approach by exploring the nature of phase wrapping observed as a recurrent folding of the phase map thus propose phase reconstruction by unfolding the wrapped phase map instead of the usual unwrapping procedure. A path-following method is presented to exemplify this technique.

1.10 16:30-16:50
Performance comparison of three processing techniques in PIV
R. González, B. Barrientos, F. Cuevas
Centro de Investigaciones en Óptica, México

Results of numerical simulations related to the application of three processing techniques in PIV are presented. The compared techniques are the standard correlation method via Fourier transform, an optical flow method (Lucas-Kanade method) and a combination of the latter and a genetic algorithm. The parameters under analysis are the particle density, the diameter of the particles, the range of displacement, the type of displacement (constant, vortex-like and sinusoidal), the noise of displacement, the size of the subimage, the intensity variations, and the profile of the particles (rectangle, Gaussian and triangular). Plots of percentage relative errors are included for each parameter

1.11 16:50-17:10
3D Displacement Distribution Measurement Using Sampling Moire Method with Multiple Cameras
D. Daiki Tomita[1], Y. Yorinobu Murata[1], M. Motoharu Fujigaki[2]
[1]Wakayama University, [2]Fukui University, Japan

A sampling moire method is useful to measure deformations of a large structure such as a building and a bridge. The sampling moire method can analyze 3D displacement using 2 cameras. The sensitivity of the displacement measurement for the z-direction is lower than the displacement measurement in the x- and the y-directions in this method because the cameras are placed near the direction of the z-axis against the object in general. However, the measurement noise level can be decreased with increasing the number of cameras. In this paper, the principle and the caliblation method to measure 3D displacement using the sampling moire method with multiple cameras are shown. As the application, 3D displacement distribution measurement of a cantilever using the sampling moire method with multiple cameras are performed. The accuracy of the 3D displacement measured with using 4 cameras is compared to the results measured with using two cameras and a laser displacement meter.

1.12 17:10-17:30
Design of a customized myoelectric hand prosthesis
A. A. Silva-Moreno, E. Lucas-Torres
[1]CIATEC, A. C., [2]Universidad Iberoamericana, Campus León, México

Hand amputation is typically the result of a traumatic injury and/or disease complication. The loss of a hand has a profound physical and psychological impact on the amputee. A high quality prosthesis can be facilitative in restoring on amputees body image. Traditional methods of manufacturing prostheses are time consuming and often lack the anatomical features to ensure the comfort of the user. The emergence of modern manufacturing technologies can ensure a higher quality of product with increased precision. In this study we designed a myoelectric hand prosthetic. A 3D scanner was used to obtain the sizes with an innovative and practical clamping system for fragile films and an internal cavity for instrumentation to measure temperature, humidity, pressure and scattered light. System is able to generate diverse pressure patterns and/or cycles in order to measure film properties such as tensile strength, flexibility, and life time. To analyze additional properties as homogeneity and transmittance properties, a multiangle laser light scattering system will be added, with detectors inside and outside pressure chamber.

2.9 16:10-16:30
Mathematical model to predict the stress concentration factor on a notched flat bar in axial tension
F. J. Ortega-Herrera, A. Lozano-Luna, J. P. Razón González, J. M. García-Guzmán, F. Figueroa-Godoy
Instituto Tecnológico Superior de Irapuato, México

This paper presents the procedure to obtain a polynomial equation to predict the stress concentration factor on a notched flat bar subjected to an axial load. For this, 100 simulations are performed using ANSYS®. Once stress fields are determined, they are used to calculate the stress concentration factor. The concentration factors versus stress are plotted in dimensionless form, and the least squares method is used to perform a multiple regression and adjust this factor to a polynomial quadratic equation. Finally the results obtained through simulations in ANSYS and those obtained by the polynomial equation are compared with the values of the concentration factor reported by other authors.

2.10 16:30-16:50
Elastic waves guided in a solid-liquid-solid system
B. Manzanares-Martinez[1], D. Moctezuma-Enriquez [2], J. Manzanares-Martinez[3], I. Ham-Rodriguez[1]
[1]Universidad de Sonora, [2]Centro de Investigación en Materiales Avanzados, [3]Universidad de Sonora, México

The waveguide properties of a liquid layer in the middle of two semi infinite half spaces are investigated. It is shown theoretically that the ultrasonic short pulse propagation through the waveguide is highly influenced by the normal modes which are calculated for the solid-fluid-solid system. Our work explores the use of the Short Time Fourier Transform analysis to identify the propagation of the different eigenmodes. The methodology presented in this work may be useful in the study of phononic crystal waveguides. The main result is the connection between the experimental ultrasonic propagation and the theoretical group velocity obtained from the dispersion relation.

2.11 16:50-17:10
Object surface representation via NURBS and genetic algorithms with SBX
J. A. Muñoz-Rodríguez, F. C. Mejia-Alanís
Centro de Investigaciones en Óptica, A. C., Mexico

An efficient technique to construct object surface model via NURBS and genetic algorithms is presented. In this technique, the object surface model is generated based on the weights and control points. These parameters are deduced by means of the genetic algorithms with simulated cross over operator. In this procedure, the genetic algorithm moves the NURBS surface toward the object surface to obtain the object shape. To carry it out, the genetic algorithm optimizes the control points based on the space solution. This space research is defined by the distance between the object surface and the NURBS surface. Thus, object model is obtained and it represents the object shape

image of the non-amputated hand. A model based on the mirror image of the hand was generated. The resulting data was transferred to a 3D printer. Individual fingers of the hand were printed (manufactured) from flexible material as separate components for the purpose of emphasizing the movement of the phalanges. Applying the above method would increase the possibility that a customized manufacture prosthesis would contain the majority of the bodily features of non-amputated hand for a subject with one hand. The method used also can be applied for the construction of prostheses for other body parts.

with high accuracy. This model is constructed in fast form. It is because the genetic algorithm converges very fast to the object surface via NURBS parameters. The contribution of the proposed technique is elucidated by an evaluation based on surface representation accuracy, continuity and speed of the traditional NURBS models based on genetic algorithms.

18:30-Callejoneada organized by the Local Organizing Committee, In front of the Church of San Diego

Tuesday, August 18, 2015

9:00-10:00 Plenary Conference — Room Antillon

Conference Chair: Andrew J. Moore, Heriot-Watt University, United Kingdom
Co-Chair: Bernardino Barrientos-García, Centro de Investigaciones en Óptica, México

Multidimensional deformation measurements using holographic interferometry
Pramod Rastogi
École Polytechnique Fédérale de Lausanne, Switzerland

10:10-12:00 Non-destructive methods Room Antillon

Session Chair: Andrew J. Moore, Heriot-Watt University, United Kingdom
Co-Chair: Bernardino Barrientos-García, Centro de Investigaciones en Óptica, México

1.1 10:10-10:40
(Invited talk) Prototype of a Handheld Displacement and Strain Distribution Measurement System Using Multiple Imaging Sensors
M. Fujigaki[1], H. Minamino[2], Y. Murata[2]
[1]University of Fukui, [2]Wakayama University, Japan

A prototype of a handheld displacement and strain distribution measurement system using multiple imaging devices is developed in this paper. The development of compact and conventional strain distribution measurement equipment for practical use is required to monitor the health and the life-lengthening characteristics of infrastructures, such as steel bridges. Digital holography is a convenient method that can be used to measure the displacement and the strain distributions on the surface of an object. Compact equipment is available due to the simplification of the optical setup. A special imaging head with eight imaging devices arranged with surrounding an incident light beam is developed. The evaluation of the displacement measurement and strain measurement using the prototype is shown.

1.2 10:40-11:00
Phase-shifting generated by wavelength modulation by means of switching on-off a laser diode
Uriel Rivera, Joris Dirckx
Antwerpen University, Belgium

It is well known that one of the features of a laser diode is its wavelength tunability which can be modulated with a variable injection current and/or temperature of its active region. For many industrial and scientific applications it is desirable that the laser gets stabilized. In this paper in contrary, the laser diode is turned on-off for a short period of time. The generated peak variations of voltage and temperature will cause a modulation of its wavelength. This modulation is used to add phase-shifts in an unbalanced Twyman-Green interferometer and by using Carré algorithm the phase of the resulting interference wave will be retrieved.

1.3 11:00-11:20
Modulation properties of a Spatial Light Modulator
Ninfa del Carmen Lozano-Rincón, Noé Alcalá-Ochoa
Centro de Investigaciones en Óptica, A. C. México

10:10-12:00 Dynamic and static structure and substructure testing Room Princesa

Session Chair: Carlos Treviño Palacios, Instituto Nacional de Astrofísica, Óptica y Electrónica, México
Co-Chair: Christhian Adonaí González-Valdez, Centro de Investigaciones en Óptica, México

2.1 10:10-10:40
(Invited talk) Applications of optical metrology to study induced strain in museum objects and inform efforts at improved sustainability
Payam Razavi[1], Koohyar Pooladvand[1], Morteza Khaleghi[1], Philip Klausmeyer [2], Cosme Furlong[1]
1 Worcester Polytechnic Institute, 2 Worcester Art Museum, USA

A major mission of museums is to preserve invaluable works of our shared cultural heritage. Current museum practices aimed at achieving this task include tight control of temperature, humidity, and light exposure in exhibition and storage areas. Increasingly, museums are faced with the challenge of how to fulfill their preservation mission in a manner that is economically and environmentally sustainable. In this paper, we present results obtained with our developed laser shearography system utilized for long-term (i.e., 24 hours or more) full-field quantifications of temperature, humidity, and light induced strains on canvas paintings under exhibition conditions. We observed that thermomechanical time constants in paintings due to environmental changes are typically longer than those of the HVAC control system. In addition, we applied 3D Digital Image Correlation (DIC) for further characterization of thermomechanical-induced strains. A goal of our investigations is to provide recommendations to help improve the performance of museums' HVAC control systems to save energy and minimize environmental impact.

2.2 10:40-11:00
Position detection of a levitated ball in a column using laser light scattering
L. F. López-Cortés[1], J. A. Huerta-Ruelas[1], A. Moreno-Baez[2], A. Hernandez-Zavala[1], O. Rodriguez-Zalapa[1]
[1]CICATA-IPN,
[2]Universidad Autonoma de Zacatecas, Mexico

Acquisition time of a measuring system to control a non-linear plant is a critical parameter in all control strategies to keep plant under stablished control limits. Fuzzy controller has been developed with an initial image based system to detect and control ball position. In this work, we present a comparison between original measuring system and a new position measuring system based in detection of scattered

Spatial light modulation (SLM) devices are used in many different areas like optical processing, holographic storage, diffractive optics, optical pulse shaping, optical metrology, etc. Because they can modulate amplitude and phase of light wavefronts, their modulation properties must be known. So, in this work, the modulation characterization of a transmissive SLM (HOLOEYE LC2012) was made by using a moiré technique. This method allows us to know the conditions under which amplitude remains mainly constant and the phase has its maximum dynamic range.

1.4 11:20-11:40

Out-of-plane deformation measurement of a pneumatic muscle by fringe projection and laser scanning

D. Migoni, B. Barrientos, C. Mares
Centro de Investigaciones en Óptica A. C., Mexico

The mechanical behavior of a Festo pneumatic muscle is presented. This muscle can be deformed by applying pressurized air. Preliminary results of the out- of-plane deformation are included. In this case, two optical techniques are used: fringe projection and laser scanning. An error analysis is described and takes into account the geometry of the cylindrical surface and the varying projected period for fringe projection and the scanning rate for laser scanning.

1.5 11:40-12:00

3D Deformation Field Throughout the Interior of Materials

Helena (Huiqing) Jin, Wei-Yang Lu
Sandia National Laboratories, California, USA

Measurement of 3D displacements and strain fields throughout the interior of a material involves three major steps: (1) in situ XCT experiment, (2) image treatment, and (3) 3D deformation analysis. We conducted a set of in-situ XCT tensile experiments of AL7075-T7351 at Advanced Light Source (ALS/LBL) that generated a large set of radiograph data for specimens at different loading states. The rendered images clearly display and provide new insight of the anisotropic damage and failure of the material. However, difficulties exist when applying the Digital Volume Correlation (DVC) technique to non-ideal tomographic images from real materials to calculate the deformation inside a material body. In this study, we tried to assess how well can the current available DVC algorithms work with non-ideal natural markers in the existing tomography data. Both global and local DVC programs were applied to selected radiographs image sets to calculate the displacement field throughout the material body. We also tried to enhance the pre-existing tomographic images via post-processing techniques such as threasholding to improve the correlation results. Some preliminary results and limitations of this method were discussed.

Acknowledgement
I am very grateful to Dr. Stephane Roux, LMT-Cahan, France and Dr. Hubert Schreier, Correlated Solutions Inc, SC for experimenting their DVC Algorithms with our tomography images.
Sandia National Laboratories is a multi-program laboratory managed and operated by Sandia Corporation, a wholly owned subsidiary of Lockheed Martin Corporation, for the U.S. Department of Energy's National Nuclear Security Administration under contract DE-AC04-94AL85000.

laser light as function of ball position, which do not require image analysis and is not sensitive to ambient conditions as images do. The system uses a semiconductor laser modulated with a 1-3 kHz sinusoidal signal with a DC level, with a lens that enlarges the beam size to the order of ball size. Signal intensity of scattered light, detected with a phase sensitive algorithm, shows a Gaussian behavior. This allows us to calculate position and speed of levitated ball quickly. At present, new experiments with a 16-detector array are underway to detect scattered light at several angles, to specifically improve velocity measurement (including its direction).

2.3 11:00-11:20

Development of a vision system for mechanical testing in metallic materials: tension and compression

K. A. Niño, K. A. Camarillo, H. Orozco
Instituto Tecnológico de Celaya, México

In this paper, the development of a vision system used in mechanical testing, tension and compression, of metallic materials is shown. A digital high-speed camera Basler A601f and the NI CVS-1450 module is implemented, allowing to process images with a resolution of 5 um. The vision system has a user interface where the inputs are the geometric characteristics of the specimen according to standard and the material used, the specimen is monitored in real -time throughout the test obtaining as outputs displacements and strains of the specimen. Compared with commercial equipment used for these tests, the vision system presented is inexpensive and may be implement in any kind of tensile-testing machine.

2.4 11:20-11:40

Computing Anterior Corneal Wavefront by Synchronous Phase-Demodulation of Concentric Rings Placido Mires

A. Gonzalez[1], A. Martínez-García[1], M. Rivera[2], M. Servin[1]
[1]Centro de Investigaciones en Óptica, A. C.,
[2]Centro de Investigación en Matemáticas, A. C., México

We present theoretical and algorithmical aspects of the Placido's rings pattern phase demodulation by using synchronous interferometric techniques. The proposed method demodulates a signal with a conic-wavefront carrier and computes a dense correspondence between a reflected pattern source and its image reflected off the cornea. This dense correspondence is computed as the phase change of the reflected waveform with respect to the reference one. This approach is more accurate and robust than the standard technique that estimates correspondences between the pixels at the binary fringe edges. Other difficulties such as irregular background light illumination, color changes due to iris color pigmentation, pupil size and reflections from eyelashes are considered. Numerical experiments with real data demonstrate the proposal performance.

2.5 11:40-12:00

Finite element static analysis simulation for a grain dispenser mechanism

J. E. Valtierra-Olivares[1], A. A. Silva-Moreno[2], B. L. Vargas-Rodríguez[1] , E. A. Ruelas Santoyo[1]
[1]ITESI, [2]CIATEC, A. C. México

The objective of this study was to identify a material for a transfer system used in packaging of gains for human consumption, which is in compliance with the regulations established by Federal Commission for Protection Against

Health Risks (COFEPRIS) of México. A static material analysis was performed testing different materials to determine the most appropriate for the mechanism connecting the grain dispensing hopper to the bagging system. SolidWorks, a computer aided engineering software was implemented for finite element analysis testing the strength, the displacement and safety of three Mexican food industry COFEPRIS compliant materials. The study revealed that the most suitable material for the connection mechanism is Derlin® 2700 NC010 (acetal resin) because of the material's high-rigidity, low-friction and positive dimensional stability.

12:00-12:30 Exhibit hall opening, hanging posters and coffee break

12:30-13:30 Plenary Conference **Room Antillon**

Conference Chair: Pramod Rastogi, École Polytechnique Fédérale de Lausanne, Switzerland
Co-Chair: María del Socorro Hernández-Montes, Centro de Investigaciones en Óptica, México

Non-invasive microtopographic inspection of rough surfaces by optical triangulation
Manuel F. M. Costa
Universidade do Minho, Centro de Física, Campus de Gualtar, 4710-057 Braga, Portugal

13:30-15:00 Lunch (on your own)

15:00-17:00 Posters session **Room Antillon**

19:00-23:00 Gala Dinner **Room Valenciana**

Wednesday, August 19, 2015

9:00-10:00 Plenary Conference **Room Antillon**

Conference Chair: Helena (Huiqing) Jin, Sandia National Laboratories, California, USA
Co-Chair: María del Socorro Hernández-Montes, Centro de Investigaciones en Óptica, México

Quantifying errors in image based measurements
Phillip L. Reu
Sandia National Laboratories, USA

10:10-12:00 Non-destructive methods Room Antillon

Session Chair: Helena (Huiqing) Jin, Sandia National Laboratories, California, USA
Co-Chair: David I. Serrano-Garcia, Utsunomiya University, Japan

1.1 10:10-10:40
(Invited talk) Acoustic Emissions In Aluminum During Uniaxial Fatigue Testing
C. Barile, C. Casavola, G. Pappalettera, C. Pappalettere
Politecnico di Bari, Italia

Monitoring crack propagation during fatigue is an important task to predict fatigue life and the overall mechanical behaviour of materials. At the same time it is quite a hard task. In this paper results obtained on notched aluminium alloy samples are reported. They were subjected to sinusoidal, uniaxial fatigue tests and they were contemporarily monitored by thermography and acoustic emission (AE). Temperature maps were collected during the whole life of the specimen and compared with the data about cumulative hits, amplitude and 1D acoustic emission source localization obtained by the AE detection system. The capability of both systems in monitoring the nucleation, stable propagation and fracture of the sample are finally discussed.

1.2 10:40-11:00
Aluminum Strain Measurement by Beam Propagation
A. Saldaña-Heredia[1], P. A. Márquez-Aguilar[2], A. Molina-Ocampo[2]
[1]Chemestry Sciences and Engineering Faculty,
[2]Research Centre on Engineering and Applied Sciences, Mexico

In mechanics of materials it is important to know the stress-strain relation of materials in order to understand their behaviour under different loads. Optical methods are used to determine different kind of stresses and interferometry is one of the most used tools. In this work it is presented a new alternative to determine stress-strain curves based on one beam which is reflected off the surface of the material (aluminium) while it is tested in a compression test as the ASTM indicates. The material is taken as a reflective surface which acts as a spherical mirror and that scatters light; the scattered area increases as the deformation increases. The reflected beam is analysed applying beam propagation equations and Digital Image Processing for getting the increase of the scattered area. Finally relation between the applied stress and the beam propagation is plotted. We also present the accuracy and the sensitivity of the method.

10:10-12:00 Dynamic and static structure and substructure testing Room Princesa

Session Chair: Phillip L. Reu, Sandia National Laboratories, USA
Co-Chair: Apolinar Muñoz-Rodríguez, Centro de Investigaciones en Óptica, México

2.1 10:10-10:40
(Invited talk) Fiber-optic sensor system for detection and localization of vibrational disturbances
M. Shlyagin, S. Miridonov, S. Stepanov, E. Hernández-Hernández, M. Plata-Sánchez, J. López-Rivera
Centro de Investigación Científica y de Educación Superior de Ensenada, Baja California, Mexico

Fiber-optic sensor systems possess important advantages for applications in explosive and flammable environments because of the dielectric nature of cables and the use of light waves for interrogation of passive sensors. In this work we developed a distributed fiber-optic sensor system for detection and monitoring acoustic and mechanical disturbances in pipelines for transportation of liquids and gaseous substances. The system contains some fiber-optic interferometric accelerometers connected into a network by means of the standard fiber-optic cable. The same cable is also used as a sensitive element for distributed detection and localization of dynamic mechanical perturbations nearby of the installed cable. The operation of the system is based on the adaptative interferometry principle, which ensures a high sensitivity and linear detection of acoustic signals and vibrations in points of interest. Detected optical signals are processed in a PC computer utilizing a special algorithm which provides the detection and localization of multiple disturbances in real time. We present a description and technical characteristics of the developed system and demonstrate results for field tests of the prototype system.

2.2 10:40-11:00
Simulation of an Adaptive Optics System using Matlab
M. A. Betanzos-Torres, J. C. Mixcóatl, S. M. Aguirre, G. B. Pérez
Benemérita Universidad Autónoma de Puebla, Mexico

This paper describes a program developed in Matlab simulating Adaptive Optics system, which allows to observe graphically simulated wavefront to understand the leading concepts of Adaptive Optics system and the constraints that have to be presented using classical algorithms Adaptive Optics. This program is based on: a) simulating a wavefront sensor Shack-Hartmann type as a detection and reconstruction of the wavefront, which by using the Zernike polynomials reconstructs the wavefront input from their slopes and b) Simulating a Deformable Mirror as system

1.3 11:00-11:20

The technique of laser-induced breakdown spectroscopy to determine the chemical composition of complex inorganic materials

A. K. Frías, A. E. Villarreal, F. G. Rendón, T. Flores, L. V. Ponce, R. Ortega, M. A. Domínguez
Centro de Investigación en Ciencia Aplicada y Tecnología Avanzada, Unidad Altamira (CICATA) of the Instituto Politécnico Nacional (IPN), México

Because of the growing industrialization, the need for a rapid and accurate chemical analysis has increased. Laser-induced breakdown spectroscopy (LIBS) is an ideal solution as it is a technique of compositional analysis which has advantages such as: in-situ analysis, it does not require sample preparation nor a large number of samples for analysis. This paper uses LIBS for analysis of Ag and Fe in complex inorganic materials (sewage). As the LIBS system uses a Nd:YAG laser emitting in a multi-pulse Q-switch regime, the emitted spectra is relatively narrow, improving the detection limits. The results generated are used for training a neural network.

1.4 11:20-11:40

Index refraction measurements in liquid substances of full field using holographic interferometry

C. A. Guerrero[1], T. Saucedo[2], M. A. Araiza[1], E. De la Rosa[1], C. Olvera[1]
[1]Doctorado en Ciencias de la Ingeniería, Facultad de Ingeniería Eléctrica, Universidad Autónoma de Zacatecas, [2]Unidad Académica de Física, Universidad Autónoma de Zacatecas, México

We present a novel method based on Digital Holographic Interferometry to detect the slight physical variations with high sensitivity in liquid substances. The technique is grounded in the measurement of a phase difference between two reconstructed wavefields. The optical system was tested using a series of sodium chloride (NaCl) solutions to detect a variation in its physical property such as concentration. A first hologram records a wavefront coming from the light scattered by a common cylindrical glass container filled with certain NaCl solution. Later, a second hologram is recorded when the solution mentioned above slightly changes its concentration. The difference between the phase maps obtained from the correlation from the two holograms will provide information about a refractive index variation, which is directly related to a concentration change. The achieved results have proven to be more accurate and fast to get than with other techniques. The process does not require many special optical elements and is able to measure the three-dimensional distribution of the refractive index of a sample. This method can be extended to identify adulteration in liquids, measure the variation in refractive index in gaseous flames, in addition to analyze and visualize the mechanical properties of a liquid sample.

1.5 11:40-12:00

Explorative analysis of resonant ultrasound spectra by electrical-mechanical analogy for osteoporosis evaluation

P. Hernández-Becerra[1], M. Balleza-Ordaz[1], J. C. Martinez-Espinosa[2], D. Ramirez-Saenz[3], M. R. Huerta-Franco[4], M. Vargas-Luna[1], I. Delgadillo-Holtfort[1]
[1]Department of Physical Engineering, Science and Engineering Division, University of Guanajuato, [2]National Polytechnical Institute- Mechatronics & Biotechnology, [3]National Polytechnical Institute- Interdisciplinary

wavefront correction. This is based on obtaining the control matrix allowing voltages needed for the deformation adopts the deformable mirror to correct the wavefront. Our results validate the reconstruction of the wavefront and the deformation of the deformable mirror graphically.

2.3 11:00-11:20

Design, development and validation of an Artificial Muscle Biomechanical Rig (AMBR) for Finite Element model validation

A. Kriechbaumer[1,4], M. P. Trejo-Ramírez[2,3], U. Mittag[1], M. Itskov[4], J. M. López-Ramírez[2], J. Rittweger[1]
[1]German Aerospace Center, Institute of Aerospace Medicine. Space Physiology Department. Germany
[2]ITESM Campus León, Mexico
[3]Universität zu Lübeck. Fachhochschule Lübeck, Germany
[4]RWTH Aachen, Department of Continuum Mechanics. Germany

In nowadays physiological research the focus has advanced from the mechanostat theory to the functional muscle bone unit investigating the relationship between muscle and bone A recent study yielded in vivo data on the deformation of the human tibia and an inverse FE algorithm which was developed to calculate the muscle forces triggering these deformations In this context an Artificial Muscles Biomechanical Rig (AMBR) was developed in order to validate the methods used and obtain further data on the relationship of muscle forces and bone deformation With AMBR the biomechanical behavior of the human tibia can be simulated comparable to the FE simulation It is a custom made mechanical platform including pneumatic actuators combined with a control system to simulate the lower leg muscles The specimen tested is a biomechanical replica of the tibia For validation and verification with AMBR tests focused on the accuracy and repeatability of data acquisition of the specimen deformation during force application using a Motion Capture system The rig was able to serve its purpose by validating the inverse FE algorithm and further applications might comprise of profounder studies of various mechanical effects of muscles on bones and create new biomechanical insights for prevention and rehabilitation.

2.4 11:20-11:40

Real-time inspection of nanostructures generated by ultra-fast laser pulses in metallic surfaces using super resolution microscopy

A. Aguilar[1], C. Mauclair[2], A. Dávila[1], R. Stoian[2]
[1]Centro de Investigaciones en Optica, Mexico
[2]Laboratoire Hubert Curien, France

Real time inspection of nano scale structures generated by ultra fast laser pulses is nowadays an area of interest due the increasing number of applications that the nanostructures have been found [1]. Nano structures can be used for generation of different optics phenomena such as polarization guiding or phase retardation [2]. In order to inspect these nanostructures which are typically beyond the resolution limit of a conventional microscope well known techniques such as SEM or AFM can be used However this kind of techniques can ' t be applied in real time In order to have a technique that allows the inspection of the nanostructures in real time Structured Illumination Microscopy (SIM) [3] is adapted in this work to analyze metallic surfaces Using SIM nanostructures generated by ultra fast laser pulses can be inspected in real time with lateral resolution beyond the diffraction limit using a conventional 0 9 NA microscope objective Experimental

Professional Unit of Engineering, [4]Department of Applied Sciences to Work, Health Science Division, University of Guanajuato, Mexico

In this work, a method to perform a parametric analysis of the osteoporosis process is explored. This method is based on the non-destructive measurement of the resonance ultrasound spectrum of rats bone tissue and its analysis in terms of the parameters of an equivalent electric circuit model. Measurements have been carried out using Panametrics piezoelectric transducers V150 (0.25MHz) on ex-vivo femur bone of female Wistar rats, of ages between puberty and menopause, in order to perform the mechanical study of the progressive changes in bone tissue related to age. results show the advantages of the proposed technique [1]Opt Express 20 12997 13005 (2012). [2]Adv. Mater. 22, 4039-4043 (2011). [3]PNAS, 102,:13081-13086 (2005).

12:00-12:30 Exhibit hall opening and coffee break

12:30-13:30 Plenary Conference — Room Antillon

Conference Chair: Katia Genovese, University of Basilicata, Italy
Co-Chair: Amalia Martínez-García, Centro de Investigaciones en Óptica, México

Volumetric Image Correlation
Hubert W. Schreier
Correlated Solutions, Inc., U. S. A.

13:30-15:00 Lunch (on your own)

15:00-17:30 Non-destructive methods Room Antillon

Session Chair: C. Barile, Politecnico di Bari, Italia
Co-Chair: Rufino Díaz-Uribe, Universidad Nacional Autónoma de México, México

1.6 15:00-15:30
(Invited talk) Texture measurement of fine arts objects by optical techniques
M. Casas[1], C. Mares[2], B. Barrientos[2], D. Sarocchi[1]
[1]Universidad Autonoma de San Luis Potosi, [2]Óptica Óptica A. C., Mexico

In this work we present the measurement of height distributions of fine arts objects by two standard optical techniques: fringe projection and laser scanning. Preliminary results show that laser scanning outperforms fringe projection when detail size is considered, but this is at the expense of the total time implied by the mechanical scanning and the image processing. The main complication of the laser technique that had to be overcome was the thickness of the projected laser line, which in this case was on the order of 0.15 mm. Results of the application of both techniques are shown for relief paintings and a textile garment.

1.7 15:30-15:50
LIBS technique for identification of crude oils
F. G. Rendón, A. K Frias, A. E. Villarreal, T. Flores, L. Ponce, G. Vázquez-Bautista
Centro de Investigación en Ciencia Aplicada y Tecnología

15:00-17:30 Dynamic and static structure and substructure testing Room Princesa

Session Chair: K. Falaggis, Warsaw University of Technology, Poland
Co-Chair: Moisés Cywiak, Centro de Investigaciones en Óptica A. C. México

2.6 15:00-15:30
(Invited talk) On the separation of triaxial strain/stress components in diffraction experiments
W. H. Wern
HTW des Saarlandes, University of Applied Sciences, Germany

The fundamental equation in x-ray diffraction relates the measured strain quantities to a superposition of six independent components, three normal and three shear components which can exist as gradients with depth. However, the linear system of equations to solve for the six components leads to a singular matrix. In such a case a nonunique solution is expected. In the literature then so called regularization methods are recommended. All these methods work only if the determinant of the matrix is close to zero, in diffraction experiments it is definitely zero because of the existence of the normal component Ɛ33 in all directions. Therefore in the past, assumptions were made such as biaxial stress states and so on. It is shown that by a numerical differentiation the shear components can simply resolved. Once the shear components have been subtracted from the fundamental equation, the three normal components remain. By a Taylor series development

Avanzada, Mexico

The potential of Laser Induced Breakdown Spectroscopy with multipulse excitation for crude oil elemental analysis is presented. Thre presence of several elements as C, H, O, S, N, Ni, V and Fe was determined. The first five elements are part of the matrix, while others are considered impurities and their content in the crude oil is in the order of traces. For trace element analysis patterns were required for quantification, which was done by preparing standard samples of known concentration in an oil matrix.

1.8 15:50-16:10

Applications of laser induced breakdown spectroscopy in the identification of bacteria

F. G. Rendón Sauz, T. Flores Reyes, R. Ortega, Izaguirre, A. K Frias, A. E. Villarreal, L. Ponce
Centro de Investigación en Ciencia Aplicada y Tecnología Avanzada, Unidad Altamira, México

Identification of microbiological objects such as bacteria, fungi and others, has become a critical task for medical, biologic and environmental surveillance. The Laser-Induced Breakdown Spectroscopy (LIBS) is a compositional analysis technique in which a laser pulse vaporizes nanogram to microgram quantities of material and thermally excites the vaporized material in a short-lived plasma; further, it shows many advantages, including no need for sample pre-treatment, easy and fast operation, chemical free during the process and the sample can be a gas, liquid, aerosol or solid. In this work LIBS is used for identification of strains Escherichia coli and Staphylococcus aureus. As excitation source, it is used an Nd:YAG laser emitting in a multi-pulse Q:switch regime favoring the intensity of the emission.

1.9 16:10-16:30

Comparison between morphological filters and Vancouver algorithm for processing Raman spectra

O. M. Lara Sigala[1], C. A. De Luna-Ortega[1], C. Frausto Reyes[2], J. R. Molina Contreras[3], C. Soberón Celedón[3]
[1]Universidad Politécnica de Aguascalientes,[2]Centro de Investigaciones en Óptica,[3]Instituto Tecnológico de Aguascalientes, Mexico

Currently, Raman spectroscopy is widely applied in the analysis of materials of art works. For processing Raman information have been considered natural and artificial systems. Within these systems, for the removal of fluorescence, are polynomials fitting methods, which allow a better approximation in the interaction between the user and the Raman technique. This kind of signal processing allows you to quickly locate the position, number and area of the peaks. In this work a comparison between two polynomial fitting methods, morphological filters and Vancouver algorithm, is made. Morphological filters give more certainty to find unresolved and low intensity peaks; on the other hand Vancouver algorithm is better for peaks with larger area. We conclude that the two methods are good for removing fluorescence however this depends on the characteristics of the spectrum.

1.10 16:30-16:50

Digital holography and Digital Image Correlation in additive manufacturing

Koohyar Pooladvand, Payam Razavi, Morteza Khaleghi, Cosme Furlong
Worcester Polytechnic Institute, USA

Additive manufacturing is a promising alternative to

of the fundamental equation, it is shown that Ɛ33 and its first derivative at ψ=0 are independent of the rotation angle ϕ. This requires a special structure of the matrix to analyse the data at different ϕ rotations. Once these two values are obtained, they serve as the initial conditions of a differential equation of second kind which is solved numerically. The unknown functions in the differential equation are approximated by a Taylor series expansion whose coefficients are determined by a nonlinear optimization procedure. Together with simulated data, first results are presented.

2.7 15:30-15:50

Two random step method for phase recovering

M. Rivera[1], O. Dalmau[1], Adonai Gónzalez[2]
[1]Centro de Investigaciones en Matemáticas, [2]Centro de Investigaciones en Óptica, Mexico

We analyse the method for computing the phase from two interferograms, I and J, with random phase shift. We assume interferograms can be preprocessed such that the background illuminations can be removed and the contrast components are constant; moreover, such illumination components are common to both images. Then the estimate of the cosine of phase step can be computed with the normalized cross correlation p = 2 <IJ>/(<I><J>); where <z> denotes the mean over all the pixel values of the image z. Then p is used to compute the phase: atan2 [Ip +J, I sqrt(1-p^2)]. We studied the relation of this method an the Gram-Schimdt orthonormalization. Our analysis of the method shows capabilities and limitations.

2.8 15:50-16:10

Thin film thickness measurement by a single Gaussian beam

Moisés Cywiak, Octavio Olvera, Joel Cervantes
Centro de Investigaciones en Óptica A. C. México

We present a technique based on the transmission of a single Gaussian beam to determine the local thickness of a thin film which can be transparent or colored. As a thin film presents constant vibration interferometric techniques are not suitable to determine their thickness making it necessary to use contact methods. As an alternative, we show how a single Gaussian beam can be used for this measurement with high accuracy, provided that the index of refraction of the film is known by other means.

2.9 16:10-16:30

Photo-oxidation of polystyrene film irradiated with UV-B

C. G. Hernández, R. González, J. J. Soto, I. Rosales
Instituto Tecnológico de Aguascalientes, Mexico

Polystyrene films were exposed to UV-B radiation during 2, 5, 7, 9 and 13 days, whose effect was evaluated by infrared spectroscopy, IR, with attenuated total reflectance, ATR. The infrared spectra of the films exposed to UV-B radiation presented an increase in the absorbance in the range of 2100-3700 cm-1, region that corresponds to the functional groups CH and OH-, which indicates that the films of polystyrene are experiencing an oxidation reaction due to the effects of UV-B radiation; in the same way, the band at 1452 cm-1, corresponding to the CH2 group, presents an increase in the absorbance; unlike the bands of 700 and 760 cm-1, which correspond to aromatic ring, show a decrease. Therefore, using UV-B irradiation is possible to change the molecular structures of the films of polystyrene.

conventional fabrication processes and has direct applications to automotive, aerospace, medical, and other industries. Multi-material manufacturing, sustainability, component functionalization, and flexibility are some of its benefits. However, microscopic, macroscopic, and functional properties of the fabricated parts are not well understood in terms of materials and process parameters. In this paper, we present our efforts in the development of Digital Holographic Interferometry (DHI) and Digital Image Correlation (DIC) methodologies for characterization of specific additive manufactured components. When used in parallel, DHI and DIC offer the complementing advantages of high spatial and temporal resolutions ranging from nanometers to millimeters and from nanoseconds to seconds, respectively. Representative results illustrating the complementing capabilities of DHI and DIC are presented, including high-speed measurements (i.e., 20 kHz or more) of transient response (high and low deformations) of additive and conventionally manufactured components. Results highlight the effectiveness of both optical method to enable quantitative and qualitative non destructive characterization of final products.

1.11 16:50-17:10
Evaluation of plane heliostats using the Null-Screen method
R. Díaz-Uribe, O. Huerta-Carranza, P. Cebrian-Xochihuila
Universidad Nacional Autónoma de México – CCADET, México

The main challenges to solve during the testing of planar heliostats used as solar concentrators in a central tower configuration by using the Null-Screen Testing Method (NuSTeM) are due to the large size of the mirrors. In the Heliostat Test Field, in Hermosillo, Son., México, there are heliostats made of mirror arrays of 55 m. In this paper we propose to use an inclined mirror-null screen set up to reduce the size of the screen used for the test; the null screen is displayed in LCD monitors. In addition, we developed an algorithm to find the orientation and position of the heliostat and null-screen relative to the camera, based on the images captured. We also will explain the way of calculating the slope maps and the elevation maps, based on the Shape of Surface Equation and the iterative integration process. Some experimental results will be shown for smaller mirrors and we will explain how to use the method for the larger ones.

1.12 17:10-17:30
Topography and color study of an object using fringe projection and colorimetry techniques
Yolanda-Yanet López[1], A. Martínez-García[1], Julián Salazar[2]
[1]Centro de Investigaciones en Óptica, [2]Universidad de La Salle Bajío, México

Apart from the topography of an object, color and texture are important parameters to study in some areas. In food industry, the variations of color and volume of a fruit are important to be assessed in order to determine its condition. Using fringe projection, the topography of an object is evaluated through time, which in turn allows us to measure the change of volume. Using colorimetric techniques, the optical devices are profiled and calibrated. The change of topography and color is studied by doing measurements every three days in order to do a comparison between consecutive states of volume and color. Thus the condition of a fruit or food can be evaluated as it evolves in time.

2.10 16:30-16:50
Dynamic analysis of trawl doors applied in bottom trawls to catch shrimp
J. Enríquez-Zárate[1], S. Sarmiento-Nafaté[2], F. García-Arredondo[3], J. Villalobos-Toledo[2], C. Pineda-García[2]
[1]CONACYT, [2]INAPESCA, [3]Universidad del Istmo, Mexico

This work deals with the dynamic analysis of a new design of trawl doors. The model is constrained to steady towing conditions with velocity constant, flat seabed and gear symmetry. The Ordinary Differential Equations (ODE) of the system includes the effects of the warp and the bridles in terms of external forces. In the mathematical model the influences of the hydrodynamic forces over the trawl doors are considers. This paper is mainly focus in show preliminary results of the mathematical model of a new design of trawl doors used to catch shrimp in the Mexican littoral. This result will be used in the future to validate the numerical model of the system with experimental results using a prototype of trawl doors designed in the laboratory of the institute.

2.11 16:50-17:20
(Invited talk) Fiber Optic Curvature Sensor
D. A. May-Arrioja[1], J. R. Guzman-Sepulveda[2]
[1]Centro de Investigaciones en Optica, México, [2]CREOL, The Collegue of Optics and Photonics, USA

A curvature fiber optic sensor using a two-core fiber (TCF) is proposed and demonstrated. The TCF, which is designed to allow coupling between the cores, acts as a directional coupler and thus offers sinusoidal spectral response. The sensor is fabricated by splicing a 50 mm-long section of TCF between two SMFs. When the fiber is bent, the coupling coefficient between the cores is modified mainly due to stress- optic effect resulting in a blue shift of the sinusoidal spectral response and then allowing performing measurement of curvature. The sensor exhibits linear response in the range from 0 to 0.27 m-1 with sensitivity of -137.87 nm/m-1.

Thursday, August 20, 2015

9:00-10:00 Plenary Conference — Room Antillon

Conference Chair: A. Albertazzi Jr., Universidade Federal de Santa Catarina, Brazil
Co-Chair: Amalia Martínez-García, Centro de Investigaciones en Óptica, México

Computer-vision-based NDE in aeronautics
Jean-José Orteu
Universite de Toulouse - Institut Clement Ader
Ecole des Mines d'Albi, France

10:10-12:00 Non-destructive methods Room Antillon

Session Chair: Jean-José Orteu, Universite de Toulouse - Institut Clement Ader Ecole des Mines d'Albi, France
Co-Chair: Víctor Hugo Flores Muñoz, Universidad Politécnica del Bicentenario, México

1.1 10:10-10:40
(Invited talk) Inspection of Laser Ablated Transparent Conductive Oxide Thin Films by a Multifunction Optical Measurement System
C. H. Hwang[1], M. H. Shen[2], S. F. Tseng[3], W. H. Hsiao[3], I. F. Cheng[2], W.C. Wang[2]
[1]Instrument Technology Researcher Center, National Applied Research Laboratories, [2]National Tsing Hua University, [3]Instrument Technology Researcher Center, National Applied Research Laboratories,
Republic of China

Laser ablation method has been increasingly used in the touch panel industry. Touch panel devices are produced by applying laser ablation process on transparent conductive oxide (TCO) thin films coated on glass substrates. The pattern and the surface profile of the transparent conductive layer on glass substrates after laser ablation are crucial on the quality of the touch panel. Therefore, a self-assembled multifunction optical measurement system was employed to investigate the details on the test specimen after ablation. The system integrates both optical microscope and white light scanning interferometer (WLSI) to inspect the specimen under the same field of view. The transmittance of the TCO thin film was obtained from the optical microscope to verify the transparency change of the test specimen after laser ablation. The depth of the ablated thin film and whether the thin film is fully cut can be determined from the surface profile obtained from the WLSI. Furthermore, the optical characteristics around the ablation region can also be obtained when the specimen is illuminated under polarized light. Based on the aforementioned experimental results, the self-assembled multifunction optical measurement system is full of potential to be used to determine the manufacturing parameters in laser ablation process.

1.2 10:40-11:00
Quantitative phase measurements using a polarization controlled nonlinear phase contrast microscope with random phase-shifting techniques
R. Porras-Aguilar[1], K. Falaggis[2], J.C. Ramírez-San-Juan[3], R. Ramos-García[3]
[1]CONACyT at INAOE, Mexico, [2]Warsaw University of Technology, Poland, [3]INAOE, Mexico

10:10-12:00 Dynamic and static structure and substructure testing Room Princesa

Session Chair: M. Fujigaki, University of Fukui, Japan
Co-Chair: Bernardino Barrientos García, Centro de Investigaciones en Óptica, México

2.1 10:10-10:40
(Invited talk) Real-time polarization imaging by polarization camera
Yukitoshi Otani, Shuhei Shibata
Utsunomiya University, Japan

We propose a real-time polarization imaging by a polarization camera and its application to Stokes polarimeter mapping and birefringence mapping. Recently, polarization information becomes important not only industry but also bio-medical engineering. All states of polarization can be expressed by Stokes parameters, which are indicated 4 parameters. It can be described linear and circular polarization or depolarization. There are also requirements of its dynamic measurement in the field of display technology, optical data storage, and living cells. Until now, many analytical methods have been proposed such as rotating polarizer and rotating retarder. These are requirements high measurement speed and calibration for wavelength dependence of retarder. In addition, a dynamic birefringence mapping is required to visualize a stress field by applying external force in transparent medium and by stretching polymer film. We have proposed a two-dimensional birefringence measurement by a polarization camera whose adjacent 4 pixels are aligned to 0, 45, 90 and 135º of azimuthal direction of linear micro-polarizer. In this paper, we extend to capture full-Stokes parameters and its application for birefringence mapping with dynamic rotating retarder and polarization camera.

2.2 10:40-11:00
Single-shot Phase shifting interferometry for microscopic measurements of non birefringent transmissive phase samples
V. H. Flores-Muñoz[1], B. Lopez-Ortiz[2], N. I. Toto-Arellano[2], A. Martínez-García[3], G. Rodriguez-Zurita[4]
[1]Universidad Politécnica del Bicentenario, [2]Universidad Tecnológica de Tulancingo, [3]Centro de Investigaciones en Óptica, [4]Benemérita Universidad Autónoma de Puebla, Mexico

It is well known the existence of a variety of techniques to obtain n- phase shifts in one shot, and most of them use diffractive or holographic elements, or pixelated phase masks attached to a CCD camera, among others, to generate from 4 to 9 interferograms simultaneously;

Quantitative phase measurements of transparent objects are demonstrated by combining polarization controlled nonlinear phase contrast microscopy with well-known phase shifting techniques. The nonlinear phase contrast microscope uses a liquid crystal (LC) cell to self-modulate the zero order of an image. The self-modulation is obtained by employing the LC cell optical nonlinearity that is placed at the Fourier plane (so that intensity is sufficiently high to induce the nonlinearity solely for the zero order). This robust system provides images with tuneable contrast that can be controlled by rotating the polarization illumination. An estimate of the phase object can be obtained using phase shifting techniques. If phase shift is well defined and fill factor is optimized, images can be used to calculate the phase of the object. However, LC materials are sensitive to small changes in intensity, temperature, etc., and the accurately control of phase modulation represents a challenge. Nevertheless, it is possible to overcome this problem by employing phase shifting algorithms that can extract the phase information from a series of interferograms having random phase shift. The principle of this common path interferometer is demonstrated via simulation and experiments for known phase objects.

1.3 11:00-11:20

Development of an automated Laser Induced Breakdown Spectroscopy system for compositional mapping of surfaces

E. Ponce-Flores[1], J. R. Domínguez-Torres[1], R. Galindo-Del Valle[1], A. E. Villarreal[2]
[1]Universidad Tecnológica de Altamira, [2]Centro de Investigación en Ciencia Aplicada y Tecnología Avanzada Unidad Altamira, Instituto Politécnico Nacional, México

Laser Induced Breakdown Spectroscopy (LIBS) is a technique for elemental determination which has advantages as versatility, not requiring of simple preparation and the ability for express analysis. In this paper the development of an automated system for compositional mapping of surfaces by LIBS is presented. The system includes an XY system drived by step motors, a low-cost compact spectrometer and a pulse Nd:YAG laser capable of deliver laser shots in "burst-mode" for sample excitation. The system can produce maps of composition in an area of 30 x 40 cm with a resolution of 12 microns. A new graphical user interface and a firmware were designed for this system.

1.4 11:20-11:40

Artificial visual system used for dental fluorosis discrimination

M. Mora-Gonzalez, E. Martínez-Cano, F. J. Casillas, F. G. Peña-Lecona
Universidad de Guadalajara, Mexico

A new technique for the estimation of the degree of fluorosis based on Dean Index and artificial vision system to improve the diagnostic of dental fluorosis by the specialists is proposed. A group of 15 people diagnosed with dental fluorosis according with the Dean Index was studied. Then, the images were digitally processed in order to discern and estimate the dental fluorosis using a discrimination algorithm based on one layer Artificial Neural Networks and probabilistic criterion. A vision system and the implemented algorithm showed the ability to detect the different degrees of dental fluorosis in accordance with the diagnosis given by the specialists. Additionally, with this technique was possible to identify the different affectation degrees of nevertheless, some of the components utilized in this arrangements are still expensive. In order to reduce the cost of operations, we developed an alternative system that does not use diffractive elements, in this research we present a simultaneous phase-shifting interferometer based on polarizing coupled interferometers, this device can be measured the optical phase of non -birefringent microscopic phase samples, generating four interferograms in single capture of the CCD camera with relative phase shifts of π/2. In order to present the capabilities of the system, the results obtained for the phase measurement of the thickness of Red Blood Cells and microorganism measurements are presented.

2.3 11:00-11:20

Mechanical implementation of Kinematic Synergy for multi-point grasping

M. A. Trejo-Letechipia, J. A. Cortes-Ramírez, H. Aguayo-Tellez
Instituto Tecnológico y de Estudios Superiores de Monterrey, Campus Monterrey, Mexico

This article presents the virtual experimentation of the dynamics for diverse multipoint grasping mechanisms, similar to the anthropometric mechanism of a human hand, using a multibody dynamic simulator. These simulations will allow the evaluation of diverse mechanisms, with the goal of selecting the one with the best performance; that is the one that has the greater energy efficiency while presenting the most equal distribution of the force along the contact points. The result tests the implementation of a grasping mechanism, and a support mechanism that allows a kinematic synergy between all the links of the mechanism, providing an immediate adaptation to the object shapes held by a force distribution along the contact points, increasing the stability of the supported object. As another result, the mechanism also allows the transmission of force in a unidirectional way by means of a mechanical arrangement in the support mechanism, which in turn permits undetermined interlocking resulting in greater energy efficiency because during this period there is no energy consumption by the actuator.

2.4 11:20-11:40

Cascaded ultra-low reflective fiber points for distributed sensing

R. Martínez-Manuel[1,2], H. S. Sutherland[1]
[1]University of Johannesburg, Republic of South Africa
[2]Centro de Investigaciones en Óptica, Aguascalientes, México

Distributed fiber sensors based on the frequency domain analysis of Rayleigh backscattered light are well established. They exhibit very good performance in both sensitivity and spatial resolution, but their application can be limited due to their cost and the complexity of the analysis. In this work we present a system based on coherent optical frequency domain reflectometry, used in Rayleigh distributed sensors, implemented with more readily available components and simplified analysis. A sensing fiber is prepared by printing uniformly spaced, ultra-low reflectivity fiber Bragg gratings of the same Bragg wavelength. When tunable source light is introduced to the fiber the reflections from the gratings interfere with the reflection from the tip of the fiber. The gratings' reflectivity varies randomly which produces a frequency domain trace that resembles a Rayleigh spectral trace, but is significantly stronger. This removes the need for specialized detection equipment. These Bragg gratings act as reflectors and not

fluorosis by dental piece. The inclusion of a vision system and an algorithm for the estimation of dental fluorosis in this technique contributes as an alternative tool for an objective diagnostic by specialists.

1.5 11:40-12:10

(Invited talk) Hybrid Single beam wave-field reconstruction techniques for partial coherent illumination

K. Falaggis, T. Kozacki, M. Kujawinska
Institute of Micromechanics and Photonics, Warsaw University of Technology, Poland

Single Beam phase reconstruction techniques are well established approaches for wavefront reconstructions in lens-less optical configurations. These methods use a series of intensities captured at various defocus distances and process this data with an algorithms in the reconstruction procedure. In this way, reconstructions with high accuracy may be achieved, provided the selected measurement planes contain sufficient information for all spatial frequency components to be measured. It is interesting to notice that these methods are also suitable under partial coherent illumination, giving further potential to reduce the level of coherent noise in the measurement system. In this work, an iterative single-beam reconstruction technique is presented that employs both non-paraxial wave-propagation based and paraxial deterministic phase retrieval techniques. This is done in order to overcome two major obstacles: iterative methods do not reconstruct slowly varying objects due to slow convergence whereas deterministic methods have paraxial limits. The hybrid approach reported here has a higher accuracy than current single beam phase retrieval techniques and in comparison to iterative methods a higher convergence speed. This work also provides guidelines how to extend these algorithms to the case of Partial Coherent Illumination.

as sensors per se. Use of a reference fiber interferometer and signal processing algorithms make it possible to replace a high precision linearly tunable laser with a DFB diode laser as optical source. The system can produce surface maps of strain or temperature.

2.5 11:40-12:00

Multibody simulation humanoid robot linking ADAMS-ANSYS

M. Ramos-Vázquez[1], G. I, Pérez-Soto[2], K. A. Camarillo-Gómez[1], R. Lesso-Arroyo[1]
[1]Instituto Tecnológico de Celaya,[2]Universidad Autónoma de Querétaro, México

In this paper, the multibody analysis of the supporting-leg of the Bioloid PREMIUM humanoid robot type A during a trajectory in the sagittal plane is presented. The analysis is developed linking the programs ADAMS for dynamic analysis and ANSYS for stress-strain analysis. The results show the behavior of the stresses and strains under dynamic conditions.

12:00-12:30 Exhibit hall opening and coffee break

12:30-13:30 Plenary Conference **Room Antillon**

Conference Chair: M. F. Costa, Universidade do Mihno, Portugal
Co-Chair: Isabel Delgadillo, Universidad de Guanajuato, México

Applied Research for Technological Development and Innovation: a success case in Laser Tech

S. E. Acosta Ortiz
Laser Tech S. A. de C.V., Research Center in Applied Physics, Mexico

13:30-15:00 Technological offers: INAOE, CICESE, CIO **Room Antillon**

Session Chair: M. F. Costa, Universidade do Mihno, Portugal
Co-Chair: Isabel Delgadillo, Universidad de Guanajuato, México

13:30: INAOE´s technological visión

David Sánchez de la Llave
Coordinación de Óptica, Instituto Nacional de Astrofísica, Óptica y Electrónica
Tonantzintla, Pue. México

14:00 Optics in Industry
Gonzalo Páez Padilla
Dirección de Tecnología e Innovación, Centro de Investigaciones en Óptica
León, Guanajuato, México

14:30 Technology capabilities at the Department of Optics in CICESE
Santiago Camacho-Lopez
Departamento de Óptica, Centro de Investigación Científica y de Educación Superior de Ensenada
Ensenada, Baja California, México

15:00-	**Closing Ceremony**	**Room Antillon**

Friday, August 21, 2015

9:00-14:00 Workshops **Centro de Investigaciones en Óptica, León Gto.**

Color Management

Juan-Manuel Bujdud-Pérez
Centro de Investigaciones en Óptica, Aguascalientes, Ags. México

Aimed at:
Graphic Designers, printers, photographers and every professional who has to deal with color reproduction.

Goal:
To get to know the basics of Color Management and the procedures used to profile monitors, scanners and printers.

Contents:
1. Principles of Colorimetry
2. Basics of Color Management
   - Device-dependent color
   - Device-Independent color
   - Components of Color Management
3. Practice work:
   - Calibration and profiling of monitors
   - Profiling of scanners
   - Profiling of printers

Requirements:
Basic knowledge about Adobe Photoshop

Introduction to Labview

Enrique-Noé Arias
Centro de Investigaciones en Óptica, León, Gto. México

Aimed at:
Undergraduate and graduate (Master's and Doctorate's) students willing to venture into the field of graphic programming.

Goal:
For the participant to acquire basic notions of graphic programming language, in order to solve problems through software.

Contents:
Introduction
Parts of a VI
Types of data (float, Boolean, string)
Creation of a SubVI
Data structures (cluster, array)
Programming structures (while, case, sequence).
Basic programming architectures (AAP, FSM)
Sequential programming logic using FSM.

Requirements:
Computer use skills
Basic programming knowledge (desirable)

Posters Session

Room Antillon

August 18

DYNAMIC AND STATIC STRUCTURE AND SUBSTRUCTURE TESTING

V ISEM & IX SOI_1 Parallel Phase Shifting Interferometry using a coupled cyclic path interferometers
B. López-Ortiz[1], N. I. Toto-Arellano[1], V. H. Flores-Muñoz[2], A. Martínez-García[3], G. Rodríguez-Zurita[4]
[1]Universidad Tecnológica de Tulancingo, [2]Universidad Politécnica del Bicentenario, [3]Centro de Investigaciones en Óptica, [4]Benemérita Universidad Autónoma de Puebla, México

In this research we have applied polarizing phase shifting interferometry to examine the morphology of red blood cells (RBCs). This system is based on a coupled cyclic path interferometer that generates parallel π-shifted interferograms which are recorded by the CCD; the separation between parallel interferograms can be varied in the two axes for convenience. For the processing of the optical phase data map, a parallel phase shift between interferograms is obtained by rotating a half wave plate retarder, which allows to obtain another set of interferograms, obtaining four interferograms with phase shifts π/2 on two shots of the CCD camera. The optical phase is processed by the four-step algorithm. Related simulations and experimental results obtained for microscopic transparent samples (RBCs) are also presented.

V ISEM & IX SOI_2 Determination of the OPD of biological and synthetic structures with polarization phase shifting triple interferometer
N. I. Toto-Arellano[1], B. Lopez-Ortiz[1], V. H. Flores-Muñoz[2], J. M. Miranda Gomez [1]
[1]Universidad Tecnológica de Tulancingo, [2]Universidad Politécnica del Bicentenario, México

Considering the deficiency of non-time resolved measurements for phase-stepping interferometric techniques and the need of developing of non-contact system capable of making an on-line measurement with high accuracy, a single-shot phase shifting Triple-Interferometer (TI) is proposed for Optical Path Difference (OPD) measurements. The proposed TI system consists of the attachment of three interferometers which generate four interference patterns, a polarizer array used as phase shifter to produce four spatially separated interferograms with pi-phase shifts. These are recorded in single capture by a CCD camera. The configuration of the TI allows dynamic measurements and does not require vibration isolation. We applied the developed system to examine the size and OPD induced by red blood cells, and the phase profile of thin films.

V ISEM & IX SOI_3 Industry application of a portable measurement system based on laser light scattering
F. A. Salazar-Vera[1], J. A. Huerta-Ruelas[1], H. Vazquez-Jimenez[1], D. A. Marin-Abarca[2], A. Corona-González[3]
[1]CICATA-IPN, [2]Instituto Tecnológico Superior De Ciudad Hidalgo, [3]Instituto Tecnológico de Querétaro, México

This work involves the development and implementation of portable optical measurement devices for detection of laser light scattered in cereal bars at different points of the process in a company in Queretaro State. Nowadays, several parts of the process in the company are not automated, increasing the number of operations which requires labor intensive. To automate the whole process of cereal bars production is necessary to make measurements during the process to provide data that serve as feedback for decision making and control the different mechanisms. Installed optical systems are a tool that provides the needed information to automate a complete production line. They are able to detect several parameters like presence of cereal bars, determine the speed of the process, count the production and/or verify product homogeneity. One of the advantages of the developed system is its compact size and low cost unlike traditional optical techniques which are expensive because lab equipment is needed. In our system, only a semiconductor laser, a detector and a low cost laptop with a USB is required.

V ISEM & IX SOI_4 Scattering of 3d complex acoustic systems by scalar surface integral equations
F. Villa-Villa[1], A. Mendoza-Suárez[2], H. Pérez-Aguilar[2], E. Villa-Martínez[3]
[1]Centro de Investigaciones en Óptica, [2]Facultad de Ciencias Físico Matemáticas-Universidad Michoacana de San Nicolás de Hidalgo, [3]División de Ciencias e Ingenierías-Universidad de Guanajuato, Mexico

We propose a numeric surface integral method to determine the scattered field produced by complex acoustic systems based on a parametric representation in terms of the arc's lengths in curvilinear coordinates. With this method, any geometry that involves quadric or higher order surfaces whose coordinate curves are orthogonal or even irregular objects that can be represented by triangle surface elements can be considered. To validate the method, calculation of modes in cubic and spherical cavities are calculated and compared to analytic results. The scattering in the far field by a rigid acoustic object is calculated.

V ISEM & IX SOI_5 Manufacturing of spherical and toroidal surfaces in lenses by using a router CNC
R. Loredo, R. Galindo, C. L. Peres, C. I. Moreno
Universidad Tecnológica de Altamira, Mexico

This paper considers the use of a mini-machine of computer numerical control (CNC) to create ophthalmic lenses by polishing curved surfaces on semi-finished lenses to obtain a desired graduation in diopters in order to manufacture glasses. In first instance, different surfaces, which are used to produce lenses, were studied. This work is especially interested on spherical and toroidal surfaces. After this, two methods of shaping the lenses were proposed: (1) using a computer-aided design (CAD) software to draw the surface, and to convert the obtained file to g-code for the CNC machine, and (2) creating a program which receives the curve parameters to produce the proper g-code. It was observed that the second approach is preferable because a better control on the finished surface is obtained. In addition, the visual C++ program permits the existence of a user-friendly interface. As a result from this Project, an improvement in the fabrication process of glasses was obtained by applying a method which uses automated manufacturing tools.

V ISEM & IX SOI_6 Mechanical characterization by ultrasonic methods ZnO-CdO-V2O5 glasses doped V2O5 Neodymium and Erbium
B. Manzanares-Martínez[1], M. E. Zayas-Saucedo[1], R. Lozada-Morales[2], E. Cervantes-Juarez[2], G. A. Morales-Morales[1]
[1]Universidad de Sonora, [2]Benemerita Universidad Autonoma de Puebla, Mexico

A not so often used technique to obtain indirectly the mechanical parameters of solid materials such as Young Modulus (E), Shear Modulus (G), among others, is by measuring the longitudinal and transverse ultrasonic velocity of the material. In this paper we present the mechanical characterization of a glass family by ultrasonic techniques, which has the advantage of being nondestructive. On the other hand, mass density values were obtainedby Archimedes Method. It can be demostrated that the samples with neodymium are slightly denser tan those doped with Erbium. Moreover, the mass density of the sample decreases as the cadmium oxide increases. The thansmission-through technique was used for the measurement of the time of flight of short time ultrasonic pulses. In this paper is described the dependence of the elastic modulus with the increasing of CdO percentage for different values of ZnO is described.

V ISEM & IX SOI_7 Analysis and data reduction from Hartmann and Shack-Hartmann tests
F. J. Gantes, Z. Malacara, D. Malacara
Centro de Investigaciones en Óptica, A. C. México

The purpose of this work is evaluate the functionality of a computer software that we designed to measure the centroids of the spots in a Hartmann pattern or Hartmanngrams. The Hartmanngrams were obtained from a Hartmann or Shack Hartmann test from some optical surface to evaluate it. Although these tests are relatively old, actually they are still in wide use because they have some advantages over other techniques, such as the sensitivity, accuracy and different configurations. With this software we evaluate how close is our results from the original data obtained by the classical technique to measure centroids. The software designed has several advantage over another techniques or computer software, since that it is an interactive and automatic software. Although the software is more complete and reliable, because it can analyze complicated pictures of Hartmanngrams and measure the centroids of the spots. We foresee that this software will be part of a complete software that realizes a wavefront reconstruction of the surface under test.

ADVANCED new materials and their characterization

V ISEM & IX SOI_8 Improving Viscosity of Concentrated Suspensions Used in Catalytic Powder Injection Molding
J. González-Gutiérrez, S. Carrillo-De Hert, A. J. Baeza-Campuzano, I. Emri
University of Ljubljana, Slovenia

Powder injection molding (PIM) is a versatile technology for manufacturing small metal or ceramic parts with complex geometry. PIM consists of 4 stages: feedstock preparation, injection molding, debinding and sintering. Among the different debinding techniques, catalytic debinding is one of the fastest. Catalytic debinding requires the use of binders based on polyoxymethyle (POM). During injection molding feedstock material should flow easily to reduce injection pressures and ensure proper cavity filling. The flow behavior PIM feedstock is strongly influenced by the particle concentration and size distribution of filler powders. In this paper, the steady state shear viscosity of PIM feedstock consisting of POM mixed with five different stainless steel powder distributions were studied. The maximum packing fraction for each feedstock was obtained by fitting viscosity data to five models from the literature. The model that best fits the experimental data also provides meaningful values of the maximum packing fraction. Using the powder distribution with the highest maximum packing fraction, it was possible to significantly lower the viscosity of suspensions while increasing the powder content, compared to commercially available POM-based PIM feedstock.

V ISEM & IX SOI_9 GSK3B is positively regulated by PKCZ mediated phosphorylation induced by WNT Agonists
N. Tejeda, M. Robles
Universidad Nacional Autónoma de México, México

Canonical Wnt signaling plays a key role in maintaining colonic epithelium homeostasis. The molecular events that drive Wnt- induced regulation of GSK-3β activity are poorly defined. In this study we observed that PKCζ and GSK-3β interact in cellulo (colon cancer cells) as evidenced by the following data, Wnt stimulation induced a rapid GSK-3β redistribution from the cytoplasm to the nuclei in malignant cells, and a transient PKC-mediated phosphorylation of GSK- 3β. In addition, while

Wnt treatment induced a decrease in PKC-mediated phosphorylation of GSK-3β in non-malignant cells, in malignant ones this phosphorylation was increased. Pharmacological inhibition and siRNA-mediated silencing of PKCζ abolished all these effects, but unexpectedly, also abolished the constitutive basal activity of GSK-3β. In vitro activity assays with GSK-3β obtained from cells stimulated with Wnt ligands, showed that PKCζ -catalyzed GSK-3β phosphorylation enhanced GSK-3β activity and confirmed that cell pre-incubation with a PKCζ inhibitor abolished the basal activity. We mapped Ser147 of GSK-3β as the site phosphorylated by PKCζ, i. e., its mutation to alanine abolished GSK -3β activity whereas the phosphomimetic sustitution of Ser147 by glutamic acid maintained the GSK-3& #946; basal activity in the absence or presence or Wnt ligands. Thus, our results indicate that PKCζ phosphorylates GSK -3β at Ser147 to maintain the constitutive activity of GSK-3β in resting cells, and that Wnt stimulation modify the phosphorylation state of this site to regulate GSK-3β activity in an opposite way in normal and malignant colon epithelial cells.

V ISEM & IX SOI_10 Syntesis and characterization of porous titanium by sps / space-holder
S. A. Vázquez-Torres, S. Y. García-Hernández, N. M. León-Lugo
ESIME IPN, México

For several years some metals have been used as orthopedic implants due to its corrosion resistance. Specifically titanium is widely recognized for its biocompatibility; in comparison with the stainless steel, that has lower specific gravity, lower Young's modulus and is classified as a bioactive material. However in the investigation to reduce discomfort post-surgery in patient has not had progress, also not in the evolution of functional biomaterials. So it was convenient for this research group synthesize metallic materials with similar to human bone characteristics. One of the most important features is the porosity, as the material must allow the transport of bone cells to be able to mimic the system. In this paper a synthesis method describe to generate titanium with different degrees of porosity by sintering. The space-holder technic was applied on Spark Plasma Sintering (SPS) equipment for porous titanium. The samples were characterized by SEM and X-Ray diffraction. The porosity in the material was 30, 40, 60 and 80%. The results suggest that the porous titanium by SPS /space- holder can be applied in the reconstruction of collapsed vertebrae.

V ISEM & IX SOI_11 Green synthesis and characterization of silver nanoparticles using an aloysia triphylla extract
J. L. López[1], R. Esparza[2], G. Rosas[1]
[1]Universidad Michoacana de San Nicolás De Hidalgo, México
[2]Centro de Física Aplicada y Tecnología Avanzada, UNAM, México

The green synthesis of metal nanoparticles has generated substantial interest because it is a method which employs no toxic substances and friendly to the environment. Besides, it can be obtained nanoparticles with well-defined shape and size. Another advantage of green synthesis of other chemical methods is that the resulting nanoparticles are surrounded by a thin layer of organic material from the plant extract, keeping them stable in solution for up to 6 months. Among the metal nanoparticles, silver has been the subject of study because of its antibacterial and antifungal properties so can be applied in areas such as medicine, food and pharmaceutical industries. Therefore, in this work is presented the results of green synthesis of silver nanoparticles using an aqueous extract of Aloysia triphylla leaves. The extract acts as a reducing and stabilizing agent. Synthesis reaction was carried out using AgNO3 aqueous solutions of 1, 3 and 5 mM as salt-precursor. Finally, the characterization of the nanoparticles was performed by means of UV-Vis, SEM and TEM. The nanoparticles obtained were mostly spherical with size range of 5-30nm.

V ISEM & IX SOI_12 Viscoelastic properties of collagen meshes modified with oligourethanes
I. O. Rivera-Debernardi[1], I. Delgadillo-Holtfort[1], P.U. Muñoz-González[1], B. Mendoza[1], A. Martínez-García[2]
[1]División de Ciencias e Ingenierías, Universidad de Guanajuato, [2]Centro de Investigaciones en Óptica, México

In this work we studied the mechanical properties of air-dried collagen meshes prepared by the collagen polymerization and its crosslinking with oligourethanes derived from poly(ethylene oxide) diols and aliphatic diisocyanates. A homemade universal testing machine equipped with a load cell of 2 pounds load capacity and a motorized stage with 1 inch length was used to perform tensile test, load-unload cycles and stress relaxation tests before and after cycle tests. Stress-strain plots show results from tensile and cycle tests. Stress relaxation results are shown in stress-time curves. A decreasing trend of relaxation time after load-unload tests was observed as an indication of changes in the material viscoelastic response.

NON-DESTRUCTIVE METHODS

V ISEM & IX SOI_13 HIFU System for non-destructive testing in biological material
P. Tavares-Ramírez[1], E. I. Cepeda[2], T. López-Luke[2], E. De-la-Rosa[2]
[1]DCI Universidad de Guanajuato, Campus León, [2]Centro de Investigaciones en Óptica A. C., México

We present a study of an ultrasonic focalized system for non-destructive testing (NDT) of samples of biological material that incorporate quantum dots; samples may be certain types of tissues. The system consists of two motors for scanning, a hydrophone which is a receptor of an ultrasound signal, a High Intensity Focalized Ultrasound, HIFU, transducer which is fed by a signal from a function generator and an oscilloscope. The control system is programmed in LABVIEW and a subprogram was coded for image processing.

V ISEM & IX SOI_14 Temperature error by separated parallel axes in radiation thermometers
J. E. Hernández-López

Centro Nacional de Metrología, México

A radiation thermometer has applications in metallurgy, mining, food, health sector, renewable energy, among others. It is so simple to use that makes it an ideal instrument for measuring temperature. Their measurements do not require the thermometer being in contact with surface. To use the thermometer properly its source size effect and size of the surface should be known. One of its technical specifications is the diameter or dot size; the dot size is a percentage of the size of its field of view. Using only a fraction of the field of view can cause errors of several degrees Celsius in temperature measurement. The thermometer can also sense something else than the region of interest. To aim the thermometer to a radiation source and see its aperture, the thermometer optical axis and the source aperture central axis must match. If the axes are parallel and there is a certain distance between them, the error by using a fraction of the field of view is further enhanced. In this work, a procedure to estimate the temperature error with separated parallel axes is described.

V ISEM & IX SOI_15 Noise reduction in off-axis digital holography reconstruction from two reconstruction distances based on Talbot effect

M. León-Rodríguez[1], R. Cordero[1], J. A. Rayas[1], A. Martínez-García[2], A. Martínez-González[3], F. Labbe[4]
[1]Universidad de Santiago de Chile, [2]Centro de Investigaciones en Óptica A. C. México, [3]Universidad Politécnica del Bicentenario, México, [4]Universidad Técnica Federico Santa María, Chile

We propose a new method based on the wave-front propagation algorithm in Fresnel regime to increase the resolution in both the axial and lateral directions of reconstructed images. The reconstructed and enhanced image are obtained from the average of the images at z=0 and half Talbot distance that is determined by a periodic component when a circular binary filter is used. The simulation result shows that the method works well when the object is bi-valued in phase and/or transmittance. This proposal can be employed as an alternative in the reconstruction process of digital holography and in any other optical methods that use the Fourier filtering method. Numerical simulations and experimental results are carried out to validate the proposed method.

V ISEM & IX SOI_16 Study of temperature distribution over a Stirling engine by using the Schlieren technique

C. Alvarez-Herrera[1], A. R. Moreno-Nieto[1], J. G. Murillo-Ramíez[2]
[1]Facultad de Ingeniería, Universidad Autónoma de Chihuahua, [2]Centro de Investigación en Materiales Avanzados S. C, Mexico

The Schlieren technique has been used to visualize and measure some relevant physical properties in transparent media such as refractive index, density and temperature. This technique was implemented to visualize temperature gradients of hot sections of a Stirling engine. Temperature gradients and temperature fields are described qualitatively and compared with temperature measurements using chromatic thermometric crayons. Furthermore, natural and turbulent heat convection were visualized from the temperature fields. The obtained results give important information about dissipation and heat transfer mechanisms that exist in a real engine.

V ISEM & IX SOI_17 Ultrasonic Arc Maps and its potential application in non-destructive testing

F. T. Moreno-Ortiz[1], A. Hernández-Zavala[2], A. Gómez-Hernández[1], N. E. Rodríguez-Olivares[1]
[1] División de Tecnologías de Automatización e Información, Universidad Tecnológica de Querétaro, Querétaro
[2] Centro de Investigación en Ciencia Aplicada y Tecnología Avanzada Unidad Querétaro, Instituto Politécnico Nacional, Querétaro, México

Ultrasound is a widely extended technique in non-destructive testing (NDT). Some of its advantages are: low cost, safety, simple to implement, environmental friendly and high reliability. The ultrasound probes are useful to detect gaps, corrosion, breakages, changes of density and impurities in materials. However, the C-scan test to produce 3D-images is complex and requires the use of a special probe made of a transducer matrix and heavy computation processing. The cross-talk, spurious echoes and the position uncertainty of the reflected point make it harder to locate spatially the true points. This work describes the ultrasonic arc maps (UAM) technique and proposes to use them in NDT. Originally, the UAM was developed for robotics to locate the true reflecting points using a simple pulse-echo transducer. The algorithms for data processing are fast, easy to program and could be embedded in a digital system like a microcontroller or a FPGA.

V ISEM & IX SOI_18 Analysis of the dynamical behavior of dry granular avalanches by fringe projection and digital image correlation

C. Mares[1], B. Barrientos[1], D. Sarocchi[2], M. Cerca[3]
[1]Centro de Investigaciones en Óptica A. C., [2]Universidad Autonoma de San Luis Potosi, [3]Centro de Geociencias, UNAM, Mexico

Dynamic three-dimensional deformation of sliding granular avalanches is presented. Experiments were done in a flume of 1 m long and 10 cm wide at a slope of 45o. Monodisperse and polidisperse granular avalanche, different in compositions and granulometric distribution were used: andesite, pumice, and mixtures of them (in one case, flour was added). The information needed for the calculation of the out-of-plane and in-plane components of displacement are contained in one shot, and are carried on the RGB data of each registered image. Preliminary results show slight differences of the out-of-plane component of deformation for the mixtures.

V ISEM & IX SOI_19 On axis fringe projection

A. Sicardi-Segade, J. C. Estrada, A. Martínez-García, G. Garnica

Centro de Investigaciones en Óptica A. C., México

The standard fringe projection technique requires a non -zero angle between projection and observation directions to have sensitivity in the z direction. In this work, a new method is presented where the angle between projection and observation directions is zero, but the system presents sensitivity due to divergent projection which changes the fringes frequency in each one of the normal planes to z-axis. The experimental results compared with the standard fringe projection technique are presented in this work to show the accuracy of the method proposed.

V ISEM & IX SOI_20 Optimization of the color-coded technique for three-dimensional deformation

C. Mares[1], B. Barrientos[1], D. Sarocchi[2], M. Cerca[3]
[1]Centro de Investigaciones en Óptica A. C., [2]Universidad Autónoma de San Luis Potosí, [3]Centro de Geociencias UNAM, México

Three-dimensional deformation of transient events can be assessed by combining digital image correlation and fringe projection. The information needed by each technique is coded on the color channels of RGB images. In this work we present a study on combinations of colors that potentially increase the accuracy of the technique when used with common materials in geology modeling. The problem with real geological materials is that often they tend to be rather dark, like andesite mixtures, and this severely restricts the range of colors that can be used to illuminate them. Mixtures of different color shades are analyzed with different light combinations from a standard projector. Results show that projector color combinations that include primary subtractive colors yield the best results for Bayer-sensor cameras.

V ISEM & IX SOI_21 Gates' interferometer as fringe projection system for recovering the 3D shape

J. A. Rayas[1], M. León-Rodríguez[2], A. Martínez-García[3], R. R. Cordero[1]
[1]Universidad de Santiago de Chile, [2]Universidad Politécnica del Bicentenario, [3]Centro de Investigaciones en Óptica, México

3D shape recovery systems based on structured light projection allow to recover three-dimensional shape from complex opaque surfaces. Particularly, when a fringe pattern with sinusoidal profile is projected and algorithms for recovering optical phase are performed for its demodulation, sub-micrometer resolutions can be obtained. The resolution is closely related to the angle formed by the axis system of projection and observation; other important parameters are the local gradient of the sinusoidal profile projected and the bit depth of the digital camera used to capture the deformed patterns. In this work the projected sinusoidal fringe pattern is generated by a Gates' interferometer where an expanded and collimated laser beam is impinged on the binding edge of a non-polarizing cube beam splitter (parallel to the splitter coating). Internal reflections and refractions of the laser beam passing through the cube generate the interference fringes that are projected over the test object. FFT technique and a simple phase unwrapping method are used to demodulation of the fringe patterns captured. Results of the three-dimensional surface of a coin that has a relief of about 150 microns with a theoretical axial resolution varying from 0.1 to 7 microns are presented.

V ISEM & IX SOI_22 Characterization of a schlieren system used to measure temperature fields in fluids flow

A. Martínez-González[1], D. Moreno-Hernández[2]
[1]Universidad Politécnica del Bicentenario, [2]Centro de Investigaciones en Óptica A.C., México

In this work we use a schlieren system to measure temperature fields in fluids flow. In the schlieren method, the deflection of light by the presence of the medium is proportional to the gradient of refractive index. In the presence of the convective fluid flow, the refraction index is related to the gas density by the Gladstone-Dale constant, which dependents on the nature of the gas and the wavelength of the light propagating in the medium. The basic idea to measure temperature by using a schlieren system is to relate the intensity level of each pixel in a schlieren image to the corresponding knife-edge position measured at the exit focal plane of the system. The intensity level of each pixel depends mainly of the refractive index variation and exposition time of the digital camera. In this form, a specific exposition time of a digital camera allows us to measure a fix range of temperatures. In this study we determine the range of temperatures that can be measure with a digital camera for different exposition times. The schlieren method is applied to the measurement of temperature fields of the air convection caused by a heated rectangular metal plate (7.3cm x 12cm). The accuracy of calculation is discussed in this study.

V ISEM & IX SOI_23 Automatic generation of codes for routine of CNC machining based on three-dimensional information obtained by fringe projection

S. Bustos[1], A. Martínez-García[2], C. Aguilera[1]
[1]Universidad del Bío-bío, Chile, [2]Centro de Investigaciones en Óptica, México

The use of machining systems through Computer Numerical Control (CNC) has highlighted advantages in the field of industrial production compared with traditional techniques. It allows a noteworthy time decreasing, higher precision and optimization of operation parameters. The control of sequences in these systems is based on codes that define the parameters to produce the machining of a determined piece. However the generation of these codes has two important challenges, first, to know the three-dimensional information of the piece to produce, and second, to define the sequence of machining through CNC. In this work fringe projection is used to obtain three-dimensional information from an object and based on this information, automatically to generate programming codes for the machining routine of a three-axial CNC milling machine. The results are applied to recover three-dimensional shape of an object based on Least Squares Algorithm, using data from 3 to 8 images. The results obtained have been successful allowing designing and manufacturing pieces in short times compared with times based on traditional methods.

V ISEM & IX SOI_24 Automatic generation of movement sequences to robotic arm based on three-dimensional data obtained through fringe projection technique
S. Bustos[1], A. Martínez-García[2], C. Aguilera[1]
[1]Universidad del Bío-bío, Chile, [2]Centro de Investigaciones en Óptica, México

The use of robotic manipulators is an issue that has gained importance in the process automation in different branches of industrial manufacturing. Today is possible to make routine works with robotic manipulator in dangerous conditions for human operators, providing flexibility in production lines, doing multiple kinds of tasks and executing actions with precision and quickness. All operations of a robotic arm are driven by a computer system that controls the mechanism positions. Since the work of these machines is to manipulate tools or pieces, is necessary to count with dimensional information of the environment or manipulated elements. In this work fringe projection is used to obtain three-dimensional shape of an object and based on this information to program the trajectories of the manipulator for the painting of complex objects through paint spraying. The obtained results have been successful, generating simulated trajectories for the painting of pieces with high quality and shorter times compared with times using traditional methods to program sequences.

V ISEM & IX SOI_25 Wavefront reconstruction by using a focus tunable lens
E. Mosso, E. Peters, D. G. Pérez
Instituto de Física, Pontificia Universidad Católica de Valparaíso, Chile

In recent years, there has been much interest on wavefront reconstruction by combining speckle properties and phase retrieval methods; great efforts have been made to apply this technique to dynamical measurements. We propose and demonstrate a new wavefront reconstruction technique using a tunable lens and a phase retrieval algorithm. Summarily, a collimated beam illuminates a rough object; the scattered light from the surface (amplitude and phase) reaches the tunable lens to produce subjective speckle distributions at a distance away from the lens plane. These speckle patterns (registered by a CMOS camera) are used in an iterative phase retrieval algorithm to successfully reconstruct the initial wavefront. We demonstrate by simulations and experiments that our approach produces high precision wavefront reconstructions suitable to outdoor environments and real-time measurements.

V ISEM & IX SOI_26 Application of optomechatronics load cell for measuring work force and efforts in industrial machinery
A. A. Camacho, F. J. Martínez-Serrano
Universidad de la Salle Bajío, México

We have been working on different phases of a project and the last one was remote monitoring. Now part of a sensor application will be reviewed on a machine that can exert loads in an industrial scale. Some results obtained by this system are shown. The principle on which this research is based is the fact that any load applied to a soil or column will scroll causing deformation, with reference to a point on an unloaded item, which is the absolute reference. Optomechatronics loading lets us determine how different points deform; for example in a column a pair of optical sensors (transmitter and receiver) send signas to a DAQ NI and they are read in LabVIEW VI. The received data are written in a database for analysis. The complete design system is applied to measuring force and stress in industrial machinery.

V ISEM & IX SOI_27 Modeling and Control of a Differential-Drive Mobile Robot for Obstacle Avoidance Tasks using Neural Networks
H. A. Méndez-Guzman, J. M. Prieto-Cerritos, J. I. Solano-Ponce
Universidad Politécnica del Bicentenario

The goal of this paper was to develop a Two-wheel differential drive mobile robot. The model of the vehicle has two driving wheels and the angular velocities of the two wheels are independently controlled. The mobile robot is able to interact with an unknown environment using a reactive strategy determined by sensory information. Localization is estimated by integrating the robot movement in a fixed sampling frequency. First, the vehicle kinematics model and the control strategies using a feedforward compensator are analyzed. Neural control of a mobile robot motion in an unknown environment with obstacles are proposed. Finally, the mobile robot simulation and experimental evaluation are illustrated. Keywords: autonomous motion, wheeled mobile robot, feedforward compensator, reactive behavior, neural networks.

V ISEM & IX SOI_28 A non-conventional rotational shear by a 4f system in a triangular cyclic-path interferometer
R. Kantun-Montiel, C. Meneses-Fabian, G. P. Lemus-Alonso
Benemérita Universidad Autónoma de Puebla

A triangular cyclic-path interferometer, TCPI, contains few elements. Typical schemas of a TCPI have been carried out principally in lateral shearing interferometry, LSI, radial shearing interferometry, RSI, and rotational shearing interferometry, RoSI. In RSI is common tilting the beam splitter by a very small angle in order to carry out CFI phase extraction, but this tilt decentres the beams. This effect is interpreted as a lateral displacement, and thus it is accepted that the lateral and radial shear are implemented simultaneously in a TCPI. In this work, we describe the implementation of a TCPI equipped with a 4f optical system in which we first demonstrate analytical and experimentally that the typical radial and the lateral shearing are removed, implying that a phase object at the input plane is not observable at the image plane. Secondly, we demonstrate the existence of a type of RoSI, but its rotational axis is parallel to y-axis, instead of z-axis, therefore if a phase object is placed at the image plane instead of input plane, the angular derivative of its phase variations over the xz plane, instead of xy plane as in typical RoSI, are observed.

V ISEM & IX SOI_29 3D reconstruction using artificial vision applied in mobile robotics
S. A. Ramírez-Arrona, O. Soria-Rodríguez, C. Arriaga-Félix, N. Luna-Padilla, V. H. Flores-Muñoz, C. P. Carrillo-Delgado
Universidad Politécnica del Bicentenario, México

We present a mobile robotic system wirelessly controlled utilizing artificial vision. The vehicle is a four-wheeled robot controlled by Arduino which receives the signal via bluetooth from a computer. The interface of the system, which was programmed in Matlab, is capable of detecting the 3D position of 2 markers that control the movement of the robot. The 3D detection is done by a stereo vision system where the cameras were calibrated using the DLT-11 method. Also the system includes an ultrasonic sensor to avoid collision with unexpected obstacles.

V ISEM & IX SOI_30 Synchronous demodulation for fringe pattern analysis and the frequency transfer function formalism
J. M. Padilla[1], M. Servin[1], J. Garcia[1]
[1]Centro de Investigaciones en Optica, A. C. México

We will present an analysis of the most popular phase-demodulation methods for fringe patterns with spatial or temporal lineal carriers following the Frequency Transfer Function (FTF) formalism and the synchronous demodulation approach. As will be shown, the FTF is a natural tool to assess the figures of merit of the phase-demodulation algorithms and consequently knowing the reliability of the estimated phase. This FTF formalism also allows us to straightforwardly design custom algorithms to cope with particular experimental conditions.

V ISEM & IX SOI_31 Measuring mechanical properties of an elastic material using electronic speckle pattern interferometry
U. Mendoza-de la Torre, A. Martínez-García, C. A. González-Valdez, A. Dávila, J. Ramírez-Sánchez
Centro de Investigaciones en Óptica, México

An investigation was carried out to evaluate the displacement field measured with a dual-beam ESPI interferometer with non-collimated illuminating beams. The displacements were induced by applying uniaxial tensile load on a nominally flat elastic sample. Although an interferometer with spherical illumination has sensitivity along the three spatial coordinates, the geometry of the used optical setup allowed us to have sensitivity mostly along the pulling direction; the other two components of the sensitivity vector were relatively small. Displacement measurements depend on the induced phase-difference and on the interferometer sensitivity vector; the latter depends in turn on the location of the illuminating sources and on the alignment of the target. We measured the displacement in direction induced only along the pulling direction. The mechanical load was applied in *y*-direction. The mechanical properties of the material are evaluated by using of displacement field.

V ISEM & IX SOI_32 Structured Light for 3D Scanning in Automotive Industry
J. Ramírez-Sánchez, A. Martínez-García, C. A. González-Valdez, U. Mendoza-de la Torre
Centro de Investigaciones en Óptica, México

In this work, the development of a device (scanner) capable of reconstruct a three-dimensional model from car panel (size of 40 cm x 25 cm) will be presented. Phase shifting interferometry and projected fringes technique are used to obtain the object digitization. Some problems presented are the shadows and specular reflections generated by the object texture and its great slope respectively.The problems are minimized by using of two simultaneous fringe projection systems. Using phase-height mapping and the 3-D coordinate calibration in phase-measuring profilometry avoids the translation of the reference plane during the calibration process. A calibration method is based in considering the projector as an inverse camera which maps 2D image intensities into 3D rays, thus making the calibration of a projector the same as that of a camera. In this way, having the 2D projected points and its 3D correspondences the system can be calibrated using a standard camera calibration method such as the one implemented in Bouguet's Calibration Toolbox. A projector-camera system has been calibrated by this method, and a good 3D reconstruction quality has been achieved by the calibrated system.

V ISEM & IX SOI_33 Specific design of eight-frame phase shifting algorithms for fringe projection profilometry: paleontological applications
J. C. Gutiérrez-García[1], A. Martínez-García[1], J. F. Mosiño[2], T. A. Gutiérrez-García[3]
[1]Centro de Investigaciones en Óptica, [2]Instituto Tecnológico de León, [3]Universidad de Guadalajara, México

Several eight-frame algorithms for their use in phase shifting profilometry and their application for the analysis of paleontological (fossilized) materials are presented. The analytic expression of all the algorithms is obtained through the convolution of a set of two-frame algorithms and expressed in terms of the combinatorial theory. Simulations and experimental results show the effectiveness and improvement of the proposed algorithms. This design of algorithms at any desired condition approach reduces significantly the influence of the detuning error. Too comparisons with other well-known algorithms are performed. The proposed algorithms do more ease the analysis of materials as fossilized samples with several optical properties that introduce problems of calibration and phase errors. Finally, a specific eight-frame algorithm tuned to recover the topography of fossilized materials is proposed.

ENVIRONMENTAL MEASURING TECHNIQUES

V ISEM & IX SOI_34 Development of automated system for processing surfaces by non-coherent pulsed light

A. E. Villarreal, L. Ponce, T. Flores-Reyes, A. K. Frías, F. G. Rendón-Sauz
Centro de Investigación en Ciencia Aplicada y Tecnología Avanzada, Unidad Altamira, México

Applications of non-coherent pulsed sources of light are varied, this due to the physical effects achieved, such as photochemical and photothermal effects produced by the wavelengths contained in the emission spectrum ranging from UV to IR. In this paper the effect of these sources is discussed when applied to surface processing of metal samples, as an alternative to cleaning lasers, using an automated scanning system. The idea is to show that the effect of ablation of the material regarded as dirt, given by the fluence of laser cleaning systems, can perform more efficiently using a pulsed light source by adapting its parameters, filtering the emitted spectrum and using appropriate focusing systems.

V ISEM & IX SOI_35 Fiber Bragg Gires-Tournois interferometer etalons as fiber sensor
A. González-García, C. I. Castañeda-Jiménez, I. Urbina-Salas, N. Rico-Jordan
Instituto Tecnológico Superior de Guanajuato, México

In this study we present results showing a fiber Bragg Gires-Tournois interferometer etalons (FBGTE), when the gratins were subjected to changes in temperature and pressure; when this interferometer is applied a uniform and linear temperature and strain in one or both gratings. The uniform temperature was to 50 oC and the results show the Bragg wavelength is shifted due to the higher temperature, and applied to the FBGTE strain in one or both gratings the Bragg wavelength is shifted after the strain. Finally when we applied a linear temperature from 0 oC to 50 oC, the results shows the spectrum is broadened due to the applied linear temperature distribution. This device is useful, for a control of compensation dispersion in WDM systems.

V ISEM & IX SOI_36 Cleaning of Tantalum capacitor electrode surface by laser in multipulse regime
A. E. Villarreal, A. K. Frías, F. G. Rendón, L. Ponce, T. Flores, G. Vázquez-Bautista
Centro de Investigación en Ciencia Aplicada y Tecnología Avanzada, México

Capacitors are electronic devices capable of storing electrical charge. These components are used in a wide range of applications in different electronic circuits. An important part of the capacitor manufacturing process is the electrode cleaning, which must be free of impurities so that it can obtain a good quality welding. Currently, electrode cleaning is accomplished by the use of chemical reagents, which leads to the possible alteration of quality through contamination. A very promising technique for cleaning metals is the use of laser. Since the early work of John Asmus, cleaning surfaces with laser showed significant advantages over conventional techniques for removing contaminants, such as: the preservation of the surface relief of the substrate, the only residue is the ejected dirt and finally the quality and accuracy of the method. This research has as main objective the removal of impurities in the electrodes of tantalum capacitors by pulsed laser technology that uses Q: Switch passive multipulse regime, and two specific objectives that are: to identify contaminants that affect terminals of Tantalum capacitors and establish the optimal parameters of laser ablation to remove these pollutants.

V ISEM & IX SOI_37 Analysis of the metrological and regulatory factors involved in the light pollution of an urban area
J. Díaz-Guadiana, J. L. J. Sánchez-González, J. Salinas-Coronado, J. I. Aguilar-Duque, G. Amaya-Parra, V. M. Juárez-Luna
Universidad Autónoma de Baja California, México

This work allows you to quickly identify the characteristics of the luminaires of public lighting and illuminated advertisements that are installed in urban areas, presenting test methods necessary for checking and compliance in the regulatory framework, in order to evaluate in field installed devices. Standards, recommendations of organizations, institutions, associations or committees, were analyzed to make a proposal that meets the characteristics required of public lighting and illuminated advertisements, in order to minimize its contribution as a factor to the light pollution of cities. The result of this work shows a summary of applicable standards, regulations and recommendations of impact to measure light and energy efficiency for the urban public lighting and the emanation of light from the installed ads. The results provided support for local administration which was conducted this research, with a capacity to adapt to other locations and amend its rules of procedure, include methodology that corroborates its relevance with inclusion of new technologies for prevention of light pollution.
Keywords: light pollution, urban areas, street lighting, illuminated advertisements, regulations

MULTI-SCALE FIELDS

V ISEM & IX SOI_38 High quality polishing procedure of glass substrates: application in integrated optics
H. E. Lazcano, J. L. Flores, A. Blanco, A. Hernandez, R. Nieto, J. L. Martinez, G. V. Vázquez
Centro de Investigaciones en Óptica, México

The manufacture of integrated optics circuits requires substrates with high quality polishing. To achieve this objective the selection of the following polishing parameters in every stage is important: work surface, abrasive grain, size, time and contact pressure. To adjust the polisher it is necessary to consider the rotational speed and the displacement of the arm that holds the work piece. In addition to verify the improvement in surface quality at each stage it is advisable to compare it with a flat pattern (to avoid that the surface becomes concave or convex). Polishing the corners between planes is very important because in general, regardless of the manufacturing process, the dimensions of the waveguides are around a few micrometers. The adjustment of different polishing parameters required to obtain substrates with high quality polishing are discussed. The material used as substrate was Corning microscope slides (2947, 75 x 25 mm, 0.9 to 1.10 mm thick). The

polishing implemented method allows us to work many substrates at the same time. The manufactured substrates, using the technique of laser writing, are used for the fabrication of channel waveguides. In our opinion, the manufacture of integrated optics devices will increase gradually so knowing these processes is of shear importance.

V ISEM & IX SOI_39 Micro-displacement measurement with a fiber bragg grating
M. A. Casas, G. E. Sandoval
Universidad Nacional Autónoma de México, México

Design and implementation of a sensor for acceleration measurements, using a fiber Bragg grating (FBG) as a sensible element, are presented. The sensor design is analyzed as a first order mechanical system (mass-spring), a cantilever beam with FBG perpendicular to the cantilever surface, fixed at the cantilever free tip and the sensor frame. The wavelength displacements in the FBG are due to the physical deformation applied all over the FBG (axial strain), caused by the bending (a displacement) of the cantilever, and this bending is directly related to the acceleration experienced by the sensor. The sensitivity obtained by the theoretical calculations is 375 pm/g.

V ISEM & IX SOI_40 Influence of recycled powders on tensile mechanical properties in direct metal laser sintering
H. Erfanian-Naziftoosi, H. Lopez, R. Elhajjar
University of Wisconsin-Milwaukee, USA

The effects of recycling powders used in Direct Laser Sintering (DLS) on mechanical properties have yet to be fully understood. The effects of laser sintering on powders not completely fused in the fabrication process may result in a degradation of mechanical properties. Previous studies on recycled powders have shown limited changes in tensile and charpy impact properties in nickel based super alloys manufactured using selective laser melting. In this study, metallic test coupons have been fabricated using recycled 17-4 stainless steel powders using the DLS technique. The objective of our study is to investigate the possibility to recycle and reuse un-sintered powders. Recycling powders in new samples has been performed for up to 11 cycles using a 17-4 grade of stainless steel. The effects of recycling powders on the mechanical properties and microstructure of samples are investigated using the acoustic emission method for insight on the development of the appropriate constitutive and failure models.

V ISEM & IX SOI_41 Production of fluorescent organic nanoparticles by femtosecond laser ablation and their characterization by the photoacoustic technique
J. E. Alba-Rosales[1], G. Ramos-Ortiz[2], M. Rodríguez[2], P. N. Hernández-Solorio[3], G. Gutiérrez-Juárez[1]
[1]Universidad de Guanajuato, [2]Centro de Investigaciones en Óptica, [3]Universidad Iberoamericana León, México

In this paper we show how to produce nanoparticles from coumarins exhibiting properties of fluorescence and two-photon absorption. These nanoparticles are produced / synthesized using the laser ablation technique; to achieve it, a small amount of dissolved material is placed on a slide, after drying is immersed in a surfactant and exposed to femtosecond pulsed radiation. The obtained nanoparticles were characterized by Photoacoustic technique, UV-VIS, fluorescence spectroscopy and TEM. Results and optical properties are compared against the reprecipitation method and the original molecule. Finally we discuss the additional information obtained from the photoacoustics characterization.

V ISEM & IX SOI_42 Organic Solar Cells
A. Nava-Vega, M. A. Cerda-Lemus, A. Trujillo
Universidad Autónoma de Baja California, México

In photovoltaic industry the research at solar cells is in continuous development, has not stopped in materials addressed. From the innovation at organics molecules until efficient plastics new products have been presented, improving the efficiencies and costs. In this work we prepared photovoltaic solar organic cells based on the work of J.L Maldonado, where proposed an improvement of the solar cells when it is used fullerene-60 as doped material. We characterized the obtained solar cells with profilometry, infrared spectroscopy, and with a scanning electron microscope, we measured the cells with a width of 2 m, determined the IR spectrum of the organic solution prepared, besides, we made an electric characterization, measuring currents of 7 m.

V ISEM & IX SOI_43 Socks for diabetics based on silver nanoparticles
L. Pérez-Mayen, N. Ahedo-del Rosal
NANOBIO AND TRONICS SA DE CV, Grupo de Nano Fotónica y Materiales Avanzados, Centro de Investigaciones en Óptica, México

In this work we show the application of nanoscience to a final product socks for diabetics Those socks are covered by antimicrobial silver nanoparticles and therefore, they are called Agtines. Those nanoparticles create a strong protection that avoids bacteria and fungi to grow into the fabric socks. This protection also eliminates bad smells and avoids injury infections in feet during the entire product´s lifetime. The antimicrobial capacity of our Agtines has been evaluated by the standard AATCC 100 2012 and we obtained 99.99 percent of reduction for Gram-positive Gram negative bacteria. The antifungal capacity has been tested by the standard AATCC 30 2013 and the result indicates that there is no fungi formation in our socks. The antimicrobial test results and the toxicity studies enable us to get a good option to prevent injuries in diabetic feet.

V ISEM & IX SOI_44 Noise attenuation for signal 1548.4 nm through a sagnac interferometer using high birefringence fiber which is subjected to temperature changes

M. May-Alarcón[1], H. H Núñez[2], M. A García-González[1], F. Méndez-Martínez[1], M. A Rodríguez-Blanco[1], V. Golikov[1], A Flores[1]
[1]Universidad Autónoma del Carmen, [2]Universidad Veracruzana, México

This paper reports the construction of an experimental setup to attenuate the ASE (Amplified Spontaneous Emission) noise around of 1548.4 nm. A Sagnac interferometer (SI) that uses high birefringence (Hi-Bi) fiber for 8, 22 and 110 cm is used as bandpass filter for attenuating the ASE noise. Temperature variations are made to tune in the filter SI. A test signal containing noise ASE is taken from an erbium-doped optical fiber and a fiber Bragg grating (FBG), therefore the 1548.4 nm signal surrounded for ASE is obtained. This test signal is introduced into the SI filter and the transmittance of the interferometer is measured, the transmittance of SI has periodic variations of maximums and minimums, the SI is tuned in with temperature to bring the maximum transmittance at the same wavelength of the signal 1548.4 nm. We found experimentally that it is possible to attenuate the ASE noise contribution around 1548.4 nm by comparing the input test signal versus the output signal at the output port of SI; also we found the displacement of the transmittance with respect to temperature, and the period of the transmittance.

Local Information

GUANAJUATO
Declared a World Heritage Site by UNESCO in 1988, the city of Guanajuato is one of Mexico's most visited spots. A former mining town, the influence of Spanish culture in the country can be seen, whether in the streets, the underground roads, alleys, temples, buildings, plazas, and gardens. It is a city wrapped with magic and legends and was at the center of history during the Mexican independence movement.

How to get there?
Guanajuato is located in central Mexico in the heart of the state with the same name. It is bordered on the north by San Felipe, Dolores Hidalgo to the east, south to Salamanca, and Irapuato and Silao and León to the west. The closest airport to the city is the Guanajuato International Airport, also known as Bajio Airport, and is located in the nearby city of Silao. National and international flights arrive daily mainly from the U.S. The road leading to Guanajuato is the highway Carretera Federal 45 or Carretera Panamericana and Carretera Federal 57. You can reach the city on a tour bus or cabs.

Climate
The climate in Guanajuato is warm in the south / southwest and sub humid temperate in all other areas. The annual maximum temperature is 36°C in the summer and a minimum of 3 ° C during the winter. The annual average is 18°C. Typically the rains come in July.

What to pack?
Comfortable shoes, shorts or pants, short sleeve shirt, light sweater for the evenings, and sneakers. In the winter wear long pants, boots, scarf, and jacket.

Activities and Attractions in the City of Guanajuato
Cervantes Monument, Pípila Monument, Peace Monument, Don Quixote and Sancho Panza Monument, Hidalgo Monument, Benito Juarez Monument, Miguel Cervantes Saavedra Monument, The gardens of Jardín Reforma and of the Unión, Basilica Collegiata de Nuestra Señora de Guanajuato, Temple of Belén, Temple of San Roque, Church of San Francisco, Church of San Diego, Santa Casa de Loreto Chapel, Church of the Compañia de Jesús and its art gallery, Sanctuary of the Cerro del Cubilete, Callejón del Beso or Kissing Alley, University students in the Atrium of the Temple San Diego de Alcalá, Callejoneadas of the Estudiantinas "folkloric music bands" (evening), Cuesta del Tecolote Hill, Campanero Bridge, Cable Cars of Guanajuato, Hidalgo Market, Underground streets of Guanajuato, University of Guanajuato, Panoramic View of the City from the Pípila Monument.

Museums: House of Legends, Mummy Museum of Guanajuato, Casa Diego Rivera Museum, Wax Museum, Gene Byron Museum, Former Hacienda San Gabriel de Barrera Museum, Quixote Iconographic Museum, Village Museum, Alhóndiga de Granaditas Museum.

Plazuela de San Fernando, Plaza de la Paz, Plaza San Roque, Plaza del Ropero dedicated to Jorge Negrete, Plaza de Baratillo, Plaza de las Ranas, Plaza Allende, Jardin del Cantador. Valenciana Mine and the Temple of San Cayetano, El Nopal Mine. Teatro Juarez, Teatro Cervantes, Teatro Principal, State Auditorium.

Author Index

SPONSORS

30 Aniversario

SEM

CONACYT

FESCIME
FEDERACION DE SOCIEDADES CIENTÍFICAS DE MÉXICO, A.C.

RIAO

SPIE

OSA
Optical Society of America

gto
orgullo y compromiso de todos
Consejo de Ciencia y Tecnología del Estado de Guanajuato

International Commission for Optics
Commission Internationale d'Optique

cideteq

Benemerita Universidad Autonoma de Puebla

Universidad de Guanajuato

INAOE

CCADET
Centro de Ciencias Aplicadas y Desarrollo Tecnologico

SATEL SA