INTERNATIONAL DIGITAL IMAGE CORRELATION SOCIETY

The International Digital Image Correlation Society will be teaching some of its most popular courses for the first time in-person in Asia on Monday, October 9, 2023 before the ATEM-iDICs '23 meeting in Awara, Fukui, Japan!

Course fees:

One full-day class
- 120,000 yen (about $800) without conference attendance
- 100,000 yen (about $700) with conference attendance

One half-day of class
- 60,000 yen (about $400) without conference attendance
- 50,000 yen (about $350) with conference attendance

Enrolled university students get a 50% discount on class fees

Overall Course Schedule
Monday, October 9, 2023

Morning Sessions	**DIC 101** ***Practical Considerations for Good DIC Measurements*** part 1 **Elizabeth Jones** **Amanda Jones** Sandia National Laboratories	**DIC 201** ***Advanced DIC Concepts and Uncertainty Quantification*** part 1 **Phillip L. Reu** Sandia National Laboratories **Mark A. Iadicola** National Institute of Standards and Technology	**Model Validation and Material Testing 2.0** ***Validating FE models and finding material parameters using DIC*** **Pascal Lava** MatchID
Afternoon Sessions	**DIC 101** ***Practical Considerations for Good DIC Measurements*** part 2 **Elizabeth Jones** **Amanda Jones** Sandia National Laboratories	**DIC 201** ***Advanced DIC Concepts and Uncertainty Quantification*** part 2 **Phillip L. Reu** **Mark A. Iadicola**	**Localized Spectrum Analysis (LSA) Method** ***Using Periodic Patterns to Measure 2D Displacement and Strain*** **Benoît Blaysat** Université Clermont Auvergne

INTERNATIONAL DIGITAL IMAGE CORRELATION SOCIETY

Monday, October 9, 2023, Full Day Class, 9:00 to 16:30 (Full Day)

DIC 101: Practical Considerations for Good DIC Measurements – What is in the Good Practices Guide.

Dr. Elizabeth Jones (Sandia National Laboratories). Dr. Jones received her PhD in Theoretical and Applied Mechanics at the University of Illinois at Urbana-Champaign. She is currently a principal member of technical staff at Sandia National Laboratories in Albuquerque, NM, where she applies DIC for material model calibration/validation and pushes the boundaries of DIC to complex and extreme loading environments.

Dr. Amanda Jones (Sandia National Laboratories) Dr. Jones received her PhD in Theoretical and Applied Mechanics at the University of Illinois at Urbana-Champaign. She is currently a principal member of technical staff at Sandia National Laboratories in Albuquerque, NM, where she applies DIC to material characterization efforts and complex loading conditions/ specimen geometries/ size scales.

COURSE DESCRIPTION

The *Good Practices Guide for Digital Image Correlation* (GPG) defines the knowledge and skills required to conduct DIC measurements in conjunction with mechanical testing of a planar test piece. Furthermore, the GPG defines the knowledge required to obtain Level 1 certification (https://idics.org/certification). The GPG is available at https://doi.org/10.32720/idics/gpg.ed1. This course will delve into all the topics covered in the GPG in detail, focusing on practical applications of DIC rather than theory or algorithms. It is designed as training for new practitioners of DIC to supplement vendor-based training and on-the-job training, and as a refresher course for those who will be taking the Level 1 certification exam.

Topics covered will include:

- Basic and fundamental 2D and Stereo-DIC concepts
- Design of DIC measurements
- Preparation for DIC measurements
- Camera calibration
- Test execution concepts
- Strain calculations and basic Virtual Strain Gauge size studies
- DIC processing techniques
- DIC reporting requirements

WHO SHOULD ATTEND

DIC users who would like a thorough review of the iDICs *Good Practices Guide for Digital Image Correlation* (GPG), and people who will be taking the Level 1 certification exam.

INTERNATIONAL DIGITAL IMAGE CORRELATION SOCIETY

Monday, October 9, 2023, Full Day Class, 9:00 to 16:30 (Full Day)

DIC 201: Advanced DIC Concepts and Uncertainty Quantification

COURSE DESCRIPTION

The advanced DIC class will cover what is underneath and beyond the Good Practices Guide (GPG). The theme will be to understand where DIC errors come from and work through all the components in DIC that lead to the measurement errors. For example, how to pick a DIC lens and camera (and why), what are the associated errors with various lenses and how do you quantify them. Why does the GPG specify 3-5-pixel speckles? What are the underlying principles? Understanding the camera calibration and the parameters and what makes a good calibration. Where does the matching uncertainty come from?

Concepts of advanced uncertainty quantification on the DIC measurement will also be discussed including a thorough look at the 2D matching error magnitudes. Stereo-DIC errors and advanced virtual strain gauge studies will also be discussed.

COURSE CONTENT

- Uncertainty quantification: What influences my DIC measurement?
- Factors in selecting a DIC lens
- Selecting a DIC camera.
- What makes a good DIC pattern and why.
- Calibration: Understanding the parameters
- Calibration: What makes a good calibration
- 2D and pattern matching uncertainty.
- Stereo-DIC uncertainty quantification
- Understanding the VSG.

WHO SHOULD ATTEND

This course will go beyond the information needed for a Level 1 certification exam and target what is needed for Level 2 certification. All DIC users who would like to learn more about what influences their measurement accuracy.

Dr. Phillip L. Reu is a Distinguished Member of Technical Staff at Sandia National Laboratories. Phillip specializes in developing novel full-field measurement techniques in previously un-measurable regimes often using digital image correlation (DIC). Current research efforts in DIC are focused on uncertainty quantification. Phillip is the author of the “Art and Application of DIC” article series in the journal of Experimental Techniques, chair of the DIC Challenge, president of the International Digital Image Correlation Society (iDICs), and paterfamilias to 6 kids.

Dr. Mark A. Iadicola is a Staff Scientist at the National Institute of Standards and Technology. Mark 's research interests include advanced experimental methods in solid mechanics as applied to multi-axial plastic deformation and stress induced phase transformation, with special emphasis on sheet metal forming and shape memory alloys (e.g. Nitinol). Mark is a past president of the International Digital Image Correlation Society (iDICs), a USA/ANSI Delegate to various subcommittees of the ISO TC164 Mechanical Testing Committee, and an active Member of Committee E28 on Mechanical Testing in ASTM International.

INTERNATIONAL
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Monday, October 9, 2023, Morning Class, 9:00 to 12:30 (½ Day)

Model Validation and Material Testing 2.0 via Full-Field Data

COURSE DESCRIPTION

Digital Image Correlation (DIC) is gradually becoming a standard tool in experimental mechanics, for both industry and academia. Despite the fact that the measurement system is often sold with the argument of being easy in use and setup, a poor understanding of issues arising in the whole measurement chain (imaging, noise, correlation algorithm, smoothing, …) can result in poor or misinterpreted results.

The workshop is led by Dr. Pascal Lava from MatchID – Metrology beyond colors, Belgium. He brings a wealth of experience in the practical application/data analysis of DIC and the identification of mechanical material properties.
http://www.matchidmbc.com

In this course, special attention is paid to MatchID 's solutions to material identification and model validation with a quantitative interpretation of the results. It is illustrated how DIC uncertainties impact the identified properties and final model validation decisions.

Having access to the spatial distribution of strains at the surface of the material via DIC enables the use of more complex test configurations to identify the mechanical behavior of materials via the Virtual Fields Method (VFM). This method is now fully integrated into MatchID 's analysis platform allowing a seamless coupling with DIC data. This method is an alternative to Finite Element Model Updating over which it has several specific advantages, among which much shorter computation times. Both linear and non-linear model examples will be included. It is demonstrated how DIC's resolution and spatial resolution might influence the final identified material properties. A methodology is presented to both evaluate the measurement performance and to optimize the test setup.

In a second slot, the above-mentioned concepts are then adopted to get an intuitive feeling on how MatchID approaches the validation of an FEA model. The methodology relies on the use of synthetic speckle image deformation to produce validation maps of finite element models from DIC data. The underpinning novelty is the fact that it considers the filtering effects of DIC, which according to MatchID, is a compulsory step to obtain robust validation. Again, the ideas are outlined based on practical examples with a clear demonstration of MatchID 's finite element validation module.

The principal goal of this workshop is not to provide a detailed theoretical study on DIC, VFM and FEA validation, but to focus on possible problems and general concepts via practical examples and how this is all integrated within MatchID.

WHO SHOULD ATTEND

Practitioners of DIC at post graduate level working in both academia and industry. In addition, engineers and researchers who have an interest in the use of full- field strain measurements to extract mechanical properties of materials or validate FEA models. Basic knowledge of DIC is required.

INTERNATIONAL DIGITAL IMAGE CORRELATION SOCIETY

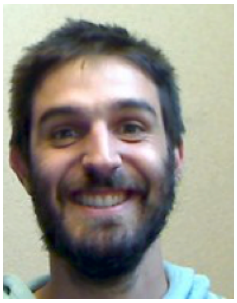
Monday, October 9, 2023, Afternoon Classes, 13:00 to 16:30 (½ Day)

Localized Spectrum Analysis (LSA) Method: Using Periodic Patterns to Measure 2D Displacement and Strain

COURSE DESCRIPTION

Local Spectrum Analysis (LSA) is a technique suitable for in-plane displacement and strain measurement. It relies on a periodic marking of the surface under investigation. This regular pattern acts as a spatial wave carrier, and the sought displacement components induce phase modulations of this carrier. Images of this periodic marking, which progressively deforms during a test, can be advantageously processed with LSA. With the windowed Fourier transform, it is shown that displacement and strain components are obtained quasi-directly, which allows the fast and pixelwise determination of the displacement and strain fields.

The aim of this course is to provide the LSA basics, with a special emphasis on its theoretical foundation and its metrological performance. Practical aspects concerning its implementation will also be discussed. Half of the course will be organized as a workshop, in which typical examples will be processed. Attendees should indeed come with their own laptop with Python and some usual libraries preinstalled.



The workshop is led by
Pr. Benoît Blaysat (Université Clermont Auvergne)
Benoit.blaysat@uca.fr

Benoit Blaysat has been a professor at the Clermont Auvergne University (Institut Pascal, France) since 2020. After a Ph. D. in computational mechanics (LMPS, former LMT Cachan, France), he decided to focus his research on experimental mechanics, more particularly on full-field measurement techniques and the related inverse problems raised by their use for material characterization purposes.

COURSE CONTENT

- Marking surfaces with periodic patterns.
- Processing images of periodic patterns to extract displacement and strain fields.
- Recent examples of use in mechanics of material and structure.
- Metrological performance: measurement resolution, bias, spatial resolution, relationship between these quantities.
- Workshop: processing various sets of dedicated images with Python programs provided to the attendees.

WHO SHOULD ATTEND

Engineers and researchers who are seeking an alternative technique of DIC, in particular in cases for which a good compromise between spatial resolution and measurement resolution is needed, for instance to capture small details in strain maps.