INTERNATIONAL
DIGITAL IMAGE CORRELATION
SOCIETY

Monday, October 14, 2019 Morning Classes, 9:00 AM to 12:00 PM

Class cost: $350 full day (any two classes) and $175 half day (any one class).

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 senior member of technical staff at Sandia National Laboratories in Albuquerque, NM, where she applies DIC to study deformation of various types of materials under complex loading conditions and develops methods to use DIC data for FE model validation.

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 senior 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. 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 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). People who will be taking the Level 1 certification exam.

INTERNATIONAL DIGITAL IMAGE CORRELATION SOCIETY

Monday, October 14, 2019 Morning Classes, 9:00 AM to 12:00 PM

Patterning for DIC

The workshop is led by Mr. Tim Schmidt from Trilion Quality Systems – schmidt@trilion.com

Tim Schmidt, Vice President of Trilion Quality Systems, is one of the most experienced practitioners of 3D image correlation and point tracking photogrammetry in the world, particularly for field tests and high-speed camera applications. Tim has run tests on days, nights and weekends for more than 17 years. He has given Basic, Refresher and Advanced training to hundreds of DIC users, and provides worldwide support for challenging measurements.

COURSE DESCRIPTION

Patterning is an essential part of every digital image correlation test setup. Although most users do avoid the worst-case scenario of "garbage in, garbage out" when it comes to patterning, there still seem to be a lot of non-optimum techniques and results in practice. Many users have concerns about their ability to produce high quality patterns without a lot of struggle, or a degree in Art. However, there are simple guidelines and methods that enable patterning to be a fast, easy and repeatable process, with straightforward quality metrics.

This course will cover everything you need to know to confidently and quickly prepare any specimen for a DIC test and be sure that patterning will not be the limiting factor for obtaining the highest quality data.

COURSE CONTENT

- The Golden Rules of Patterning
- Patterning for the Most Common Test Setups
- Removing Human Factors from Patterning
- Pros and Cons of Spray Paint, Ink, Rubber Stamps, Airbrushes, Markers….
- Masking How's and Whys
- Pre-Test to Check Your Pattern (And Everything Else, Too)
- (System Noise as Opposed to DIC Noise)
- The Ideal Pattern vs The Real World
- What to Do When Larger Dots Are Required
- Evolution of Various Patterning Methodologies
- Small-Scale and Microscale Patterning Techniques
- What About Naturally Occurring Patterns?
- High Temperature and Very High Temperature Patterning
- Some Lighting Techniques – How to Make Your Patterns Look GOOD

And

- Most Common Beginner's Mistakes
- Bad Ways to Do Good Patterns
- Fantastic Examples of Terrible Patterning

WHO SHOULD ATTEND

It is hoped that all current or potential users of DIC would benefit from this course.

INTERNATIONAL DIGITAL IMAGE CORRELATION SOCIETY

Monday, October 14, 2019 Afternoon Classes, 1:00 PM to 4:30 PM

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 vice 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.

Monday, October 14, 2019 Afternoon Classes, 1:00 PM to 4:30 PM

The Grid Method

COURSE DESCRIPTION

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

This course aims at providing the principle of this technique, with a special emphasis on its theoretical foundation and metrological performance. Practical aspects concerning its implementation will also be discussed.

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

Benoit Blaysat is an associate professor at the Clermont Auvergne University (Institut Pascal, France) since 2013. After a Ph. D. in computational mechanics (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 grids
- Processing grid images to extract displacement and strain fields
- Recent examples of use in mechanics of material and structures
- Metrological performance: measurement resolution, bias, spatial resolution, relationship between these quantities. Link and comparison with subset-based DIC
- Tutorial: processing various sets of grid images with Matlab 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.