TRAINING COURSE

Digital Image Correlation in Materials Testing

Use and application of DIC in mechanical testing

22 Oct 2027

online

TRAINING CHAIR

Dr.-Ing. Matthias J. Merzkirch
University of Augsburg

DGM

TRAINING COURSE

Digital Image Correlation in Materials Testing

Use and application of DIC in mechanical testing

22 Oct 2027 08:30 - 17:00

Online

Digital Image Correlation (DIC) plays a growing role in (not restricted to) destructive characterization of structural materials. The advantage lies in the possibility of visualizing large areas for occurring deformations and strains of the object of interest under different loading conditions. This non-contact metrology is applicable to almost every material class, making its applicability almost infinite. It is not only used for the determination of material properties or for quality testing in manufacturing but also for test inspection. The seminar describes theory and application of Digital Image Correlation for selected standardized and common state-of-the-art tests, for the mechanical characterization of structural materials under common loading conditions. The purpose of this seminar is to provide good practice guidelines for setting up and conducting Digital Image Correlation measurements in conjunction with mechanical testing of test specimens in general-purpose laboratory conditions. In order to obtain accurate and representative material data, it is important being minute and careful when planning, performing, and evaluating experiments. Many inherent difficulties of tensile, shear, flexure, and fracture testing are addressed where pertinent measurement issues are visualized with DIC. The more you see, the less you can hide. Digital Image Correlation offers a new look at old problems of structural mechanics, presenting a detailed insight into mechanical testing of materials, which cannot be covered by point measurements.

TRAINING CHAIR

Dr.-Ing. Matthias J. Merzkirch
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Target group

The training course is best suited for:

- Scientists, engineers and technicians working in research and development as well as industrial production, process and quality control.
- Managers and salespeople with a basic technical understanding who work in this or a related field and want to benefit from materials-oriented further training.
- People with a basic technical understanding who work in the fields of digital image correlation, strain measurement, composites or in related fields and would like to benefit from materials-oriented further training.

Goals

Digital Image Correlation (DIC) provides the unique ability to visualize deformation and strain over large areas of structural materials, enabling a critical understanding of material behavior under various loading conditions.
Here are the key reasons why this course will benefit your company:

- **DIC Fundamentals:** Understand the basic principles of DIC, including setup, pattern application, and parameter selection for accurate measurements.
- **Practical Insights:** Explore practical aspects, such as preparation of specimens, design of DIC measurements, and data reduction methodologies.
- **Mechanical Tests:** Learn how to use DIC for a variety of ASTM, ISO and DIN standardized mechanical tests (tensile, shear, flexure, and fracture) under common loading conditions.
- **Measurement Precision:** Understand the precision and uncertainty of DIC, the factors affecting it, and how to improve the reliability of your test results.
- **Quality Control:** Use DIC in quality control to detect manufacturing defects or material inconsistencies.
- **Interdisciplinary Understanding:** Connect experiments and mechanical models by visualizing DIC results.
- **Practical Exercises and Applications:** Expand your knowledge with practical examples and exercises, as well as multiple application cases.
- **Discuss your specific real-world application/problem with experts.**

Use this opportunity to advance your company's technology and gain a competitive advantage!

Organizational matters

The book "Mechanical Characterization Using Digital Image Correlation - Advanced Fibrous Composite Laminates" by Dr.-Ing. Matthias Merzkirch will be used as training documents. The e-book is included in the participation fee and will be provided digitally to the participants in advance

If requested, participants can obtain the hardcover version at a discounted price. This will not be included in the participation fee.

Online participation takes place via the DGM's browser-based conference platform. For access, we recommend the latest browser versions of Google Chrome, Mozilla Firefox, Safari or Microsoft Edge. Registered participants will receive all access information in advance by e-mail. For an optimal user experience, we also recommend installing the latest software version of ZOOM on your device.

The platform will be activated one day before the event. Log in to the conference platform with your DGM user account. If you have forgotten your access password, you can generate a new one via "Forgot password". The event will be recorded and will be available as a video in the same place for up to two weeks afterwards.

The video explaining the DGM conference platformshows you all the available functions.

Please note that all times are given in Central European time (CEST).

Overview

22 Oct 2027 (Fri)

08:30	Welcome and Introduction
09:00	Theory of Digital Image Correlation (DIC)
10:10	Practical Use of DIC
11:10	DIC Experiment Preparation - Setup and specimen
13:00	Tensile Testing
14:00	Flexural Testing
15:10	Notched Specimen Testing
15:50	Fracture Testing
16:30	Summary and Discussion, and Wrap-up

Program

22 Oct 2027 (Fri)

08:30 Lecture

Welcome and Introduction

This is an introduction to the seminar program and a presentation of the speakers:

- The introduction and program overview provide an outline of the training's content and structure. A round of introductions helps everyone get to know each other and encourages interaction throughout the event. It also gives participants the opportunity to express their goals and expectations at the beginning of the training.
- The DGM places great importance on promoting communication between participants and speakers, as well as among participants. Valuable contacts are often made during this time and can be beneficial in a professional context later on.

Dr.-Ing. Matthias J. Merzkirch
University of Augsburg

09:00 Lecture

Theory of Digital Image Correlation (DIC)

The training begins with an introduction to the theory of Digital Image Correlation (DIC), covering its underlying physical principles and common methods. Participants will learn how DIC works, including the fundamentals of digital image processing and the use of grey level images for accurate displacement and strain measurements. The session will also introduce both 2D and stereo DIC techniques, highlighting their differences and use cases. Additionally, the importance of calibration procedures will be discussed to ensure measurement accuracy and reliable data interpretation in practical setups.

Dr.-Ing. Matthias J. Merzkirch
University of Augsburg

10:00 Break

Coffee Break and Discussion

10:10 Lecture

Practical Use of DIC

This part of the seminar provides participants insights into how to work with DIC systems effectively. This includes setting up and operating the equipment, selecting appropriate lenses and cameras, and understanding their influence on image quality and measurement accuracy. The session explores a broad range of applications in experimental mechanics and materials testing, demonstrating how DIC can be applied to analyze deformation, strain distribution, and crack propagation under various conditions. Participants will learn how to adapt DIC techniques to suit each experimental setup.

Dr.-Ing. Matthias J. Merzkirch
University of Augsburg

11:10 Lecture

DIC Experiment Preparation - Setup and specimen

Effective use of DIC begins with proper preparation of the setup and test specimens. This includes careful alignment of cameras, lighting considerations, and the selection of suitable lenses to optimize image capture. A critical aspect is the application of appropriate patterning techniques, which directly influence the accuracy and resolution of the measurements. Participants will learn how to evaluate and quantify pattern quality to ensure reliable data. The session also covers uncertainty measurement, helping users understand the limitations of their setup and how to minimize errors. Finally, guidance will be provided on the choice of DIC settings, such as subset size, step size, and filtering parameters, all of which play a crucial role in the precision and robustness of the results.

Dr.-Ing. Matthias J. Merzkirch
University of Augsburg

12:00 Break

Lunch break

13:00 Lecture

Tensile Testing

The application of DIC in tensile testing provides a full-field analysis of strain distribution and local deformations. This session covers the complete testing setup using stereo-DIC, including camera positioning, lighting, and calibration procedures. Emphasis is placed on specimen preparation and high-quality patterning, which are essential for accurate strain measurements. Participants will learn how to conduct testing analysis and apply data reduction schemes to extract key mechanical properties such as modulus, and strain at failure directly from DIC data. The course also addresses sensitivity and uncertainty studies, providing insights into how variations in DIC settings and experimental conditions can impact the reliability of the results. Special focus is given to strain concentration phenomena, and how these are influenced by DIC parameters like subset, step, and window size, ensuring a deeper, engineering-based understanding of material behavior and measurement accuracy.

Dr.-Ing. Matthias J. Merzkirch
University of Augsburg

14:00 Lecture

Flexural Testing

The use of DIC in bending tests enables detailed visualization of deformations and accurate determination of bending properties in materials. Special attention is given to patterning across small thicknesses, which is critical for capturing precise strain measurements in thin specimens. The session also highlights common mistakes during flexural testing, such as improper specimen alignment or inadequate support conditions, and discusses how these can affect DIC results and overall test accuracy.

Dr.-Ing. Matthias J. Merzkirch
University of Augsburg

15:00 Break

Coffee Break and Discussion

15:10 Lecture

Notched Specimen Testing

Notched specimen testing with DIC allows detailed analysis of strain concentrations near notches, providing critical information about local deformation behavior. The accuracy of these measurements is influenced by DIC settings such as subset step and window size, which affect the resolution and reliability of strain data in highly localized regions.

Dr.-Ing. Matthias J. Merzkirch
University of Augsburg

15:50 Lecture

Fracture Testing

Fracture testing using DIC enables detailed investigation of deformation and strain fields around cracks in precracked specimens. This approach provides valuable insights into crack propagation and local material behavior, with measurement accuracy depending on factors such as DIC settings and specimen preparation. This session covers the complete testing setup using 2D-DIC, including camera positioning, lighting, and calibration procedures.

Dr.-Ing. Matthias J. Merzkirch
University of Augsburg

16:30 Lecture

Summary and Discussion, and Wrap-up

Dr.-Ing. Matthias J. Merzkirch
University of Augsburg

Dr.-Ing. Matthias J. Merzkirch

University of Augsburg

Dr.-Ing. Matthias Merzkirch has been leading the "Condition Monitoring" group at the Institute of Materials Resource Management at the University of Augsburg since June 2024. He also coordinates the research focus on "Learning Manufacturing Processes & Closed-Loop Production" within the AI-Production Network Augsburg.

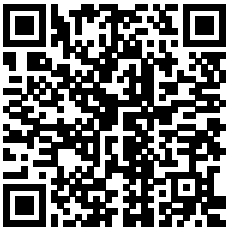
Prior to this, he was a senior researcher in structural analysis and modeling at the Research Institutes of Sweden (RISE) in Mölndal, Sweden, from 2021 to 2024. Between 2016 and 2020, he served as a guest researcher at the National Institute of Standards and Technology (NIST) in Gaithersburg, Maryland, USA.

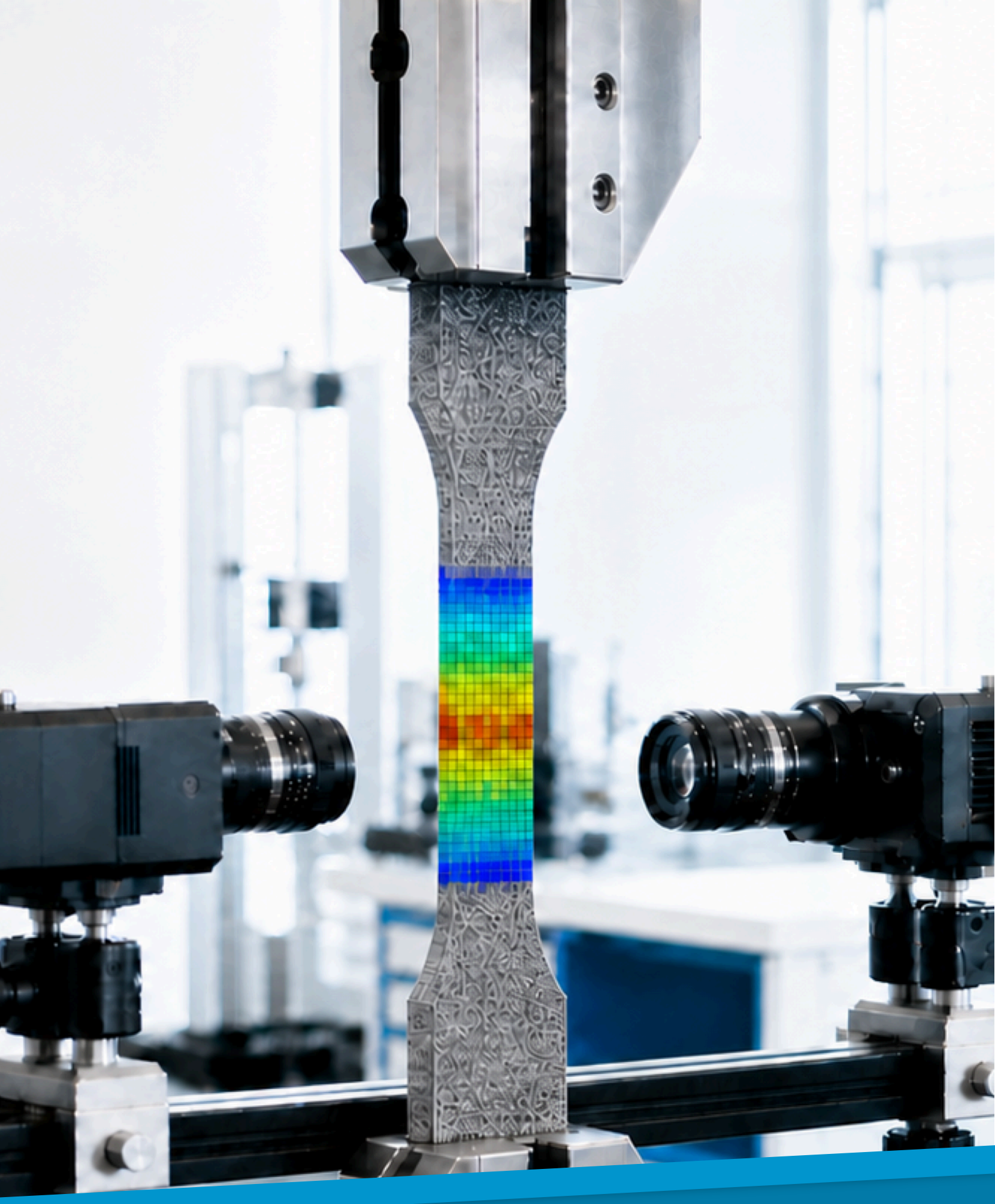
Dr. Merzkirch completed his PhD in mechanical engineering at the Karlsruhe Institute of Technology (KIT) in 2012, after which he worked as a scientific coordinator at KIT. He has also been a guest lecturer at both the Karlsruhe University of Applied Sciences (HKA) and KIT. An active member of the International Digital Image Correlation Society (iDICs), Dr. Merzkirch contributes to a committee focused on standardization.

Contact person

DGM-Akademie-Team
akademie@dgm.de
+49 (0)69 75306 760

https://dgm.de/akademie/en/events/digital-image-correlation-in-materials-testing-2027





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