

iDICs Standardization, Good Practice, and Uncertainty
Quantification Committee

A GOOD PRACTICE GUIDE FOR DIC

iDICs

INTERNATIONAL
DIGITAL IMAGE CORRELATION
SOCIETY

iDICs Annual October 2018

SCOPE

- ▶ 2D and stereo-DIC (not volumetric DIC)
- ▶ Single DIC system: One camera for 2D-DIC and two cameras for stereo-DIC
- ▶ Optical-based images (no images based on, for example, scanning electron microscopes, atomic force microscopes, or X-rays)
- ▶ Standard machine vision cameras and optical lenses (no images from, for example, microscopes, stereo microscopes, or high-speed cameras)
 - ▶ NOTE: Not specifically limited to quasi-static testing, but does not cover high speed imaging.
- ▶ Local, subset-based DIC algorithms (as opposed to global algorithms)
- ▶ Common Mechanical Tests:
 - ▶ Planar test pieces undergoing nominally planar motion and/or deformation
 - ▶ Strain range of up to approximately 60% equivalent strain
 - ▶ Test piece size of approximately 50 mm to 1 m
 - ▶ Laboratory testing with well-controlled environment (e.g. room temperature, minimal vibrations)
 - ▶ No special environmental conditions (e.g. no environmental chambers, no water tanks or pressurized vessels, no windows or viewports, no explosions or shock waves)

WHAT THE GUIDE IS AND IS NOT INTENDED TO BE!

▶ The Guide IS intended to be

- ▶ generally applicable good practices
- ▶ advice to get us all on the same page
 - ▶ process
 - ▶ performance
 - ▶ terms
 - ▶ reporting
- ▶ a reference for ourselves, our collaborators, publications, and standards
- ▶ a living document that will grow
 - ▶ scope
 - ▶ content
 - ▶ version/edition
- ▶ retained for reference (i.e. previous editions)
- ▶ FREE at <http://idics.org/guide> <https://doi.org/10.32720/idics/gpg.ed1>

▶ The Guide IS NOT intended to be

- ▶ a replacement for hands-on or vendor specific training
- ▶ a tutorial on the basics of digital imaging
- ▶ hardware specific
- ▶ software specific
- ▶ unchanging
- ▶ sold for profit

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GUIDE DEVELOPMENT & APPROVAL

- ▶ Between November 2016 and November 2017 the Working Group developed a consensus draft of the Guide
- ▶ From November 2017 to January 2018 there was a Public Comment Period that anyone could opt-in to review the guide
- ▶ A total of 100 Participants joined in the Public Comment Period
- ▶ 56 Participants formally voted
 - ▶ 23 voted "Approve without comment"
 - ▶ 32 voted "Approve with comments and suggestions"
 - ▶ 1 voted "Disapprove with comments (at least one technical) and suggested revisions"
 - ▶ Based on the voting rules, the remaining 44 non-responding were considered "Approve without comment"
- ▶ Over 500 comments and suggested revisions, of which over 130 were technical
- ▶ Based on the voting rules (2/3 majority approval required), the Guide was Approved by the Public Comment
- ▶ Based on the voting rules, the Working Group attempted to address as many of the comments as possible
- ▶ Summary of Revisions after the Public Comment Period
 - ▶ Technical and editorial revisions were made
 - ▶ Working Group approved the revisions
 - ▶ Three iDICS Board Members were given a three week review period to review the revised Guide
 - ▶ The Board Member comments were satisfactorily addressed
- ▶ Based Public Approval and the Board Members' Approval, the Guide was found to be Approved by iDICS

GUIDE FOCUS AREAS

- ▶ Measurement Design
- ▶ Hardware Selection
- ▶ Setup
- ▶ Post Processing
- ▶ Terminology
- ▶ Reporting
- ▶ Assisting the reader
 - ▶ Measurement check list
 - ▶ Process flow chart for the guide
 - ▶ References

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Start-Finish:
How to do a
good DIC
measurement

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Start-Finish:
How to do a
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unfortunately
limited figures
and examples, at
this time

FORMAT OF THE GUIDE

SEM MEETING: DIRECT MAIN POINTS FOLLOWED BY NOTES, DETAILS, AND SUGGESTIONS

Section Text:

Describes the section topic and what is required¹

¹Footnotes: supplementary information beyond the scope of the guide

Recommendation

Suggested specific actions or decisions that should be followed to achieve very good DIC measurements.

Tip

Supplementary and background information, particularly useful to inexperienced DIC practitioners, but without a specific action or decision.

Caution!

Events, decisions, or features that can have potentially negative impacts on a DIC measurement. Cautions are frequently followed by Recommendations to avoid or mitigate the issue.

Tip 2.27

Pretesting of extra test pieces may be required to verify the suitability of a pattern throughout the duration of the test.

Tip 2.28

Even at strains where decorrelation does not occur, pattern degradation can result in reduced correlation quality and increased uncertainty in the measurement [7].

2.3.2.5 Reflections

The pattern sheen should be matte and not glossy, to avoid glare and specular reflections.

Caution 2.21

Specular reflections can often be hidden in an otherwise good DIC pattern (i.e. appearing as artificial bright spots in one or both of the camera images). Specular reflections are dependent on the orientation and position of the test piece with respect to the light source and camera, and can change if the test piece is rotated or translated. Additionally, in stereo-DIC, specular reflections often look different in each camera, which effectively makes the DIC pattern different and uncorrelated in each FOV. Therefore, specular reflections should be avoided.

Recommendation 2.18

To reduce specular reflections, use cross-polarized light, or diffuse light, as described in Recommendation 2.11 in Sec. 2.2.4. If specular reflections cannot be sufficiently minimized through the lighting, a photographic dulling spray can be applied to the DIC pattern. However, if a dulling spray is used, the DIC pattern should be carefully evaluated, to ensure that the spray does not degrade the pattern.

2.3.3 Characteristics of Applied Patterns

Applied patterns, regardless of the method used to create them (i.e. painting, applying an adhesive-backed foil or sticker, stamping or drawing with ink, applying a powder, transfer printing, etc.), should have the following additional characteristics, which do not necessarily apply to natural patterns.

Recommendation 2.19

For tensile tests, before applying a pattern to the test piece, mask the grip sections so that the pattern is not applied to the areas of the test piece that will be gripped in the load frame. This will help increase grip force, reduce likelihood of the test

PROCESS FLOW CHART

GOOD PRACTICE GUIDE: APPENDIX A (HIGHLIGHTS)

Start

DESIGN OF DIC MEASUREMENTS

- MEASUREMENT REQUIREMENTS
- HARDWARE REQUIREMENTS

BEFORE CALIBRATION

- INITIAL SETUP
- SYSTEM CHECKS

CALIBRATION

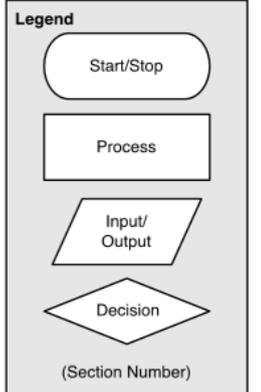
AFTER CALIBRATION

- VERIFICATION
- OTHER CHECKS

TEST WITH DIC

- ### ANALYSIS
- UNCERTAINTY
 - VIRTUAL STRAIN GAUGE

REPORTING



SPREAD THE WORD!

THE GUIDE IS NOW PUBLISHED AND READY FOR USE

- ▶ Get a copy at <http://idics.org/guide>
- ▶ Share the link with your colleagues
- ▶ Follow the reporting requirements in your publications
- ▶ Check for the reporting requirements in the publications you review
- ▶ Please cite the document when you use it

International Digital Image Correlation Society, Jones, E.M.C. and Iadicola, M.A. (Eds.) (2018). A Good Practices Guide for Digital Image Correlation. <https://doi.org/10.32720/idics/gpg.ed1>

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