

# PROCEEDINGS OF SPIE

## ***Interferometry XIX***

**Katherine Creath  
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*Editors*

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# Introduction

This is the nineteenth installment of the Interferometry conference – it has not always taken place in the current bi-annual format, so its beginnings reach back to the 1980s. For those of you who are old enough to remember, take a moment to re-play the reel of progress since; for those who are not, take a look at a yellow book with a three-digit number or download a scanned typewriter manuscript, marvel at the clumsy ways things were done then, and realize that the reason we are looking so much smarter today is because we are. All the mistakes we make (and share), all this apparent erring and bumbling leads to knowledge of how we might have begun in the first place — just one case and success story in point: the Laser Interferometer Gravitational-Wave Observatory founders having won the 2017 Nobel Prize in Physics. As such, we understand this book to be another chapter in the endless chronicle of trial, error, and improvement.

This is our second conference where we have combined “Techniques and Analysis” and “Applications”. The late August date of the meeting this year has conflicted with the start of school for many of our colleagues. We look forward to having them join us next time. As we do each time we meet, we are looking forward to the discussion with you about the future and format of the conference. We strive to include as many new topics and new presenters from around the world as possible with each conference.

With this conference we have an on-site proceedings – meaning the published papers are available at the meeting to the attendees. We have found this adds substantial depth to our interactions and conversations with one another. The hard part about this is reminding and pestering authors to get their papers in on time. We review every paper and ask authors to revise their papers according to the reviewers' comments. The Chairs would like to encourage potential authors to start such foreseeable processes early – being focused on the scientific results, it is easy to forget about the more mundane things around attending a conference. Also, from experience, it is a good idea to have at least part of the results already “in the bag” – there is not one among us who has never experienced the last-minute rush that comes with trying to meet a deadline that involves the rest of the experimental program besides the writing process.

Having said that, we do applaud our authors, and are very happy with the quality of the material we did receive. As usual, it has gone through a peer-review process with our 37 committee members from 17 countries to ensure we all get a conference volume that will be useful as a reference for many years. The featured authors, from 14 countries, have brought inspiring papers to this forum, which we are very pleased to present in this book. It contains 48 papers presented at the SPIE's 63<sup>rd</sup> Annual Meeting in San Diego on August 18 – 23, 2018. Over 40 of these papers were presented orally.

When thinking of interferometry, the first thing coming to mind is of course the phase of wavefronts, as used so beautifully in non-destructive testing and holography. One feature of this conference is continuation of the Chandra S. Vikram Award Lecture. This year we are featuring the current 2018 Chandra S. Vikram Award winner Karl A. Stetson of Karl

Stetson Assoc., LLC presenting his work “From the speckle interferometer to digital holography,” as well as the 2010 Chandra S. Vikram Award winner James C. Wyant giving a retrospective of his career titled “A wonderful life of holography, interferometry, and optical testing.” We’re highlighting these presentations with ample time for questions, and we’re sure you’ll enjoy presentations and papers of both these giants in our field. We plan to continue highlighting winners of this award at future conferences.

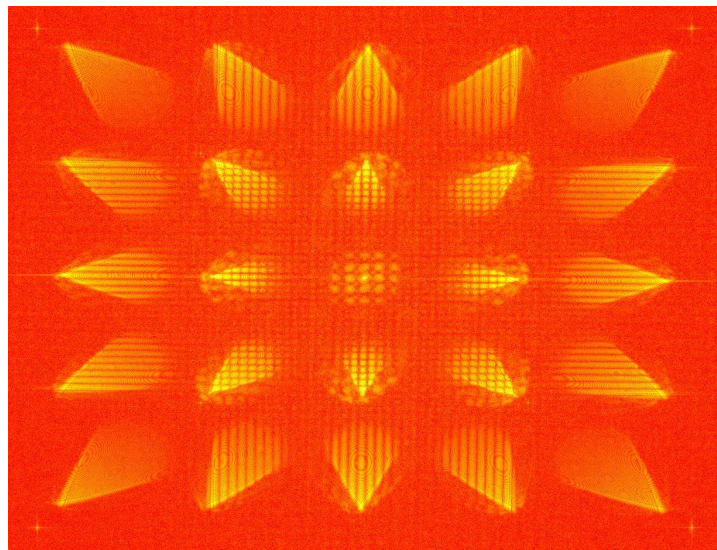
While LIGO was surely the cover story of the last 2 years, we have a number of other contributions on pushing the boundaries of metrology and detection methods, as well as further progress reports on the timeless topic of advanced fringe generation and analysis. Calibration methods are the foundation of quantitative metrology, and this topic is also covered by several authors from different areas of research. A useful complement to interferometry is deflectometry, using geometrical optics for measurements with very high dynamic range, and some practical applications of the technique are featured in this volume.

Further classical topics such as speckle interferometry and digital holography are also represented – just like any other topic, they started as tentative new ideas several decades ago and are now serving as an established base for many initially unusual ideas of today. Finally, we have a section on multiple-beam interferometers, viz., very sensitive grating sensors, whose principles are also well known and whose use continues to spread.

The range of topics presented reflects the versatility and ubiquity of optical metrology – like the photon itself, it pervades our world, and its importance is most easily recognized in its absence.

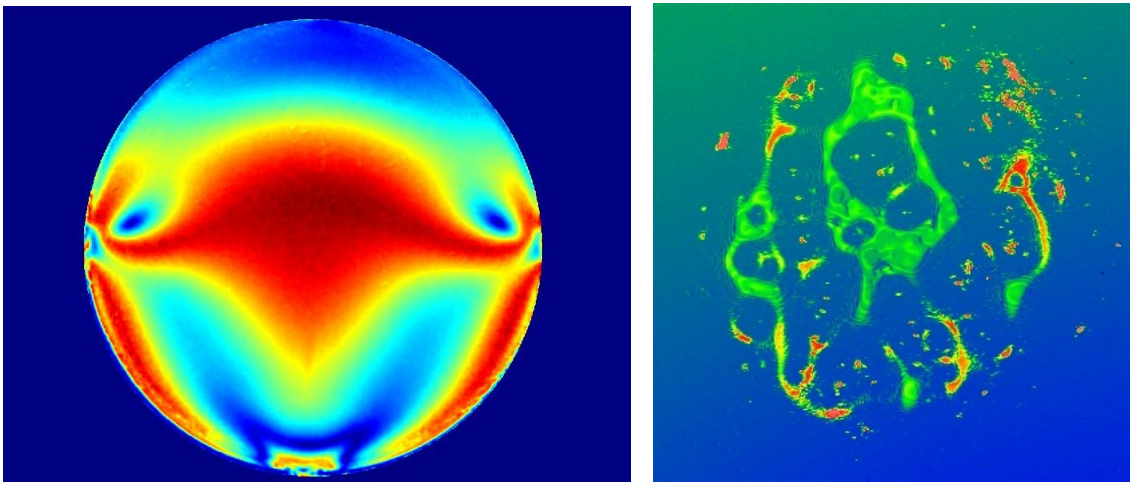
During our last conference in 2016, we had once more a very lively and fun Fringe Art competition with several rounds of voting, choosing our favorite fringe patterns from those brought along by attendees. The origin of phenomena submitted to the Fringe Art Competition spanned the range from Ronchi gratings and biofilms to more common applications such as defect detection, moiré, vibration and stress patterns, cracks, and crystals.

The image selected as the favorite was submitted by Łukasz Służewski, Krzysztof Patorski, and Maciej Trusiak of Warsaw University of Technology, Institute of Micromechanics and Photonics. This image represents the 2D Fourier spectrum of an interference fringe pattern obtained using a 2D Ronchi grating shearing interferometer. A spatial filter after the



grating passes the lowest 3 x 3 diffraction orders. The test lens was placed backwards to produce spherical aberration that gives rise to the comatic features in the Fourier image. The dark fringes across the comatic spots correspond to 2<sup>nd</sup>-order spatial derivatives of the spherical aberration, and the weak cross patterns over the zero and 1<sup>st</sup>-order spectra are due to parasitic interference caused by multiple reflections in the CCD cover glass. In other words, the features in this wonderful picture are not things you really every want to see when you're testing a lens, but here they are as a work of art.

Our 2<sup>nd</sup>-place winner shows a colorful residual stress pattern in PMMA by Achyut Adhikari of the Center for Optical & Laser Engineering in Singapore. And, finally, our 3<sup>rd</sup>-place winner shows a bacterial biofilm titled "Beautiful Bug" by Curtis Lamier of the Pacific Northwest Laboratories.



Let us close with a sincere thank-you to SPIE, the program committee, the authors, and everyone attending this nineteenth Interferometry conference. As we have said a number of times, metrology never goes out of style, and a few things deemed too hard or even impossible even two years ago have been demonstrated now, encouraging further demands for the (almost) impossible (again, who of us has not experienced this?!). Besides the incremental broadening of scopes and sharpening of sensitivities, there were also "the usual surprises", i.e. innovative uses opening up new ways of thinking. We are very pleased that SPIE continues to support and provide this forum for us.

Until next time!

**Katherine Creath**  
**Jan Burke**  
**Michael B. North-Morris**  
**Angela D. Davies**

