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Interferometry XVIII

**Katherine Creath
Jan Burke
Armando Albertazzi Gonçalves Jr.**
Editors

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Introduction

This is the eighteenth 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. As such, we understand this book to be another chapter in the endless chronicle of trial, error, and improvement.

A trial with this conference is that this time we do not have the two subconferences “Techniques and Analysis” and “Applications” but rather a combination of the two. We have had fewer contributions than usual; this may have to do with the late date for the meeting, which for many has been after the summer break – but possibly also with confusion as to what the new format means and where to place contributions. As at the time of writing, we are looking forward to the discussion with you about the future and format of the conference.

There have been unusually many withdrawals this time, due to various reasons, ranging from visa issues to clearance for publication. 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 the authors who decided not to rush things along just for the sake of the deadline, and we are very happy with the quality of the material we did receive. As usual, it has gone through a peer-review process to ensure we all get a conference volume that will be useful as a reference for many years. The featured authors, from 18 countries, have brought inspiring papers to this forum, which we are very pleased to present in this book. It contains 44 papers presented at the SPIE’s 61st Annual Meeting in San Diego on August 30–September 1, 2016. Thirty-two of these papers were presented orally.

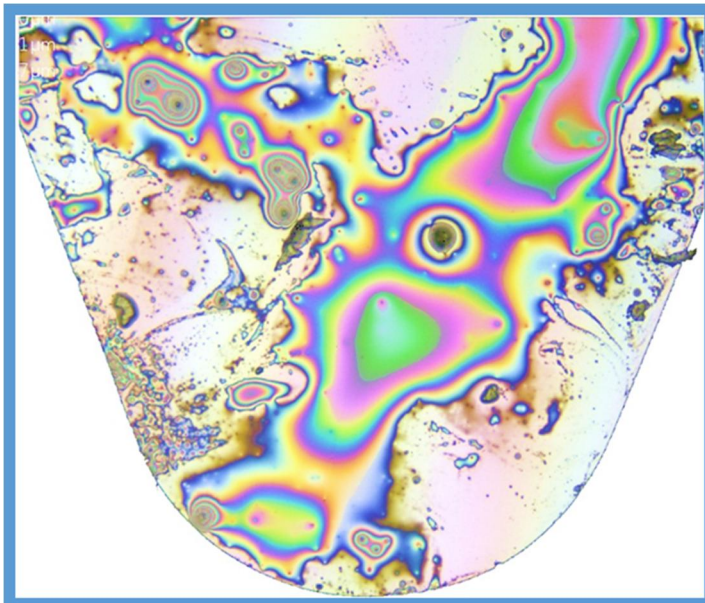
When thinking of interferometry, the first thing coming to mind is of course the phase of wavefronts, as used so beautifully in non-destructive testing and holography. One feature of this conference is the Chandra S. Vikram Address, a look upon the past (and future) of holography, given by the 2016 winner of the Vikram Award, James D. Trolinger. We plan to continue highlighting winners of this award at future conferences.

Of course, the wavefront measurement can also gainfully be coupled with other properties of light, such as polarization and coherence, whose manipulation and use are featured in a number of exciting applications. We have mentioned LIGO above, and part of this year's Plenary program is an overview of the progress and observations made with the advanced version of the instrument, which from the outside looks like just a giant Michelson interferometer, but requires a very large number of tweaks to achieve a level of sensitivity that even Einstein could not imagine.

While LIGO is surely the cover story of this year, 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 2014, 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 mouse neurons and ear drum vibrations to more common objects such as vibrating cantilevers, moiré, diffraction patterns, and waves caused by wind on San Diego harbor and Coronado beach.

The image ultimately selected as the favorite was submitted by Dr. Jake Beverage, then at Zygo Corp., Middlefield, CT USA (now with Arizona Optical Systems, Tucson, AZ USA). The image is of a cutting tool covered with a thin oil film, viewed through the ZYGO Nexview™ interference microscope with color imaging. The imaging area is 0.9 mm x 0.9 mm. In the image you can see both the faint interference fringes as well as the thin film interference.

Let us close with a sincere thank-you to SPIE, the program committee, the authors, and everyone attending this eighteenth Interferometry conference. As we have said last time, 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
Armando Albertazzi Gonçalves Jr.

