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Introduction

These inaugural proceedings for the Conference on Photonic Instrumentation Engineering present a record of a multidisciplinary forum for the measurement of light and its exploitation as a measurement tool. Light serves as a foundation of life, provides us with the ability to observe the world, and satisfies our curiosity to explore the world. The ability of humanity to question and explore the world around us is one of our most unique defining traits. In particular, the development of tools and instruments to measure and quantify the world around us is, in a large sense, what enables modern science and engineering, hearkening back to the days of the Royal Society itself.

In its most primeval form, light has been used since antiquity for measurement purposes, ranging from the ancient seafaring art of celestial navigation by starlight to the most modern of concepts, measurement of the finite speed of light itself. The first determination of the speed of light in 1676 was a major breakthrough in the recognition of our position in the universe. By timing motion in the moons of Jupiter, the Danish astronomer Ole Roemer put a finite time scale to the most fleeting of events -- the motion of photons through physical space. It is perhaps coincidental that almost concurrently (at least in historical terms) with the determination of the most important property about light, the first light-based microscope instruments were being employed in the Netherlands to discover the vast treasure of microbial life. In the late 18th century, optical instrumentation helped to provide the first official definition of the meter, perhaps the most fundamental physical constant in science. Over the past 400 years and counting, the explosion in optical instrumentation has not ceased.

Measurements by or about light represent science on both the smallest and largest scales, and such diversity is well represented in the papers within this conference. There are papers representing all aspects of science, engineering systems, and measurement regimes. Optical instruments are presented within this conference ranging in size from the Giant Magellan telescope (designed to measure the extent of physical phenomena on the order of light years) to electron-beam lithography measurement tools providing single-nanometer accuracy. A series of ruggedized instruments is presented that are designed to work in the harshest environments: near molten steel, immersed in chemical media, withstanding high vacuum, and on top of wind turbines on the open sea. Presentations exploiting both high *order* (in the form of semiconductors and fiber Bragg gratings) and designed *disorder* (in the form of Anderson localized modes for light transport) conspire to illustrate how photonic systems can easily employ widely disparate physical phenomena. The design and development of photonic instrumentation systems for sustained life are represented as well, manifested in presentations on design tools for biophotonics and *in situ* fiber sensing for biological environments.

Even within the realm of optics and photonics, the interdisciplinary nature of instrumentation systems, techniques, and physical phenomena is growing with exponential complexity. Providing a common ground and forum for new ideas to spread between the fundamental and the practical is critical to the continuation of science and engineering. We hope to see a strong and continuing interest in such a wide range of optical instrumentation, as well as the engineering required to realize it.

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