
SPECIAL SECTION EDITORIAL

Laser interferometric techniques have been used in the field of biomedical optics since the 1960s. One of the first applications was concerned with measuring the visual acuity of cataract patients. In the 1970s, laser interferometric measurements of corneal thickness and first applications of laser Doppler velocimetry to measure the velocity of blood flow were reported. Since the second half of the 1980s the advent of compact and rather cheap multimode laser diodes and superluminescent diodes enabled the application of white light interferometry to the field of biomedicine. This paved the way for a new field of research and led to the introduction of several new diagnostic instruments.

On the one hand, new miniaturized fiber optic sensors were developed. On the other, instruments for high precision distance measurements, low or partial coherence interferometers, were developed or adapted to the special needs of biomedical applications. This latter technique was further developed into optical coherence tomography (OCT), a new non-invasive imaging modality capable of obtaining high resolution cross-sectional images of transparent and semi-transparent tissues. In the meantime, even a commercial OCT instrument for imaging of retinal structures is in the market. The dynamic expansion of this field of research encouraged us to edit a special section on Interferometry in Biomedicine in the *Journal of Biomedical Optics*. We received a large number of submissions, and since all the papers that were recommended in the peer review process could not be accommodated in this special section, they have been transferred to the special section titled "Coherence Domain Optical Methods in Biomedical Science and Clinics," to be published in April 1998 under the editorship of Valery Tuchin, Halina Podbielska, and Christoph Hitzenberger.

Nine papers are presented in this special section. One deals with classical interferometry, i.e., a low-coherence light source is used: Licznerski, Kasprzak, and Kowalik report on a new method of evaluating the stability of the tear film of the human eye. They use a lateral shearing interference technique and measure the tear film breakup time by fast Fourier transforms of consecutive interferograms. Another paper is concerned with new fiber optic temperature sensors: Rao et al. demonstrate an in-fiber Bragg grating (FBG) flow-directed thermodilution catheter based on interferometric detection of wavelength-shift for cardiac monitoring and another FBG sensor with a tunable Fabry-Perot filter for *in vivo* temperature profiling in NMR machines.

The majority of the papers deals with optical coherence tomography: four report on improvements or results of "conventional" OCT, i.e., OCT based on the classical approach of a Michelson interferometer in

combination with a low coherence light source and a moving reference mirror. J. Schmitt investigates a special iterative point-deconvolution algorithm, originally developed for radio astronomy, as a means of restoring OCT images of scattering tissue. He shows that it is possible to reveal tissue morphology not evident in the unprocessed images. Baumgartner et al. demonstrate an improvement of the signal-to-noise ratio in retinal OCT by the use of a special wavefront matching technique. Furthermore, these authors demonstrate the improvement of axial resolution by employing a broadband light source in combination with a compensation of the dispersion of the ocular media. Drexler et al. present new results on the origin of OCT signals obtained from retinal structures. By comparing the OCT signals recorded in healthy subjects with those recorded in certain pathological cases, the origin of the signals can be determined. Bouma et al. report on new light sources for OCT imaging of human tissue: they extend the wavelength range farther into the infrared region employing a stretched-pulse, mode-locked Er-doped fiber laser with center wavelength of 1.55 μm and a Tm-doped silica fiber fluorescent source emitting at 1.81 μm .

Three papers discuss alternative OCT schemes. Podoleanu et al. altered the geometry of OCT sections. By using the pathlength modulation caused by the x-y scanner of their instrument, they demonstrate the recording of transversal or en-face OCT images in the human retina *in vivo*. Hellmuth and Welle report on a method that allows measurement of not only distances but also the absorption spectrum and the dispersion of the sample. Their method is based on a combination of a Michelson interferometer with a Fourier transform spectrometer. Häusler and Lindner demonstrate two different techniques: employing a Michelson interferometer-based low coherence technique with a two-dimensional CCD sensor, they are able to record the surface topology of human skin in very short time. With a technique based on spectral interferometry, they demonstrate the recording of OCT sections of the human skin.

The fact that several other papers on the subject had to be moved to the special section of the April issue of the journal clearly demonstrates the intense research efforts and importance of interferometric applications in the biomedical field.

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Special Section Editors