



Medical Physics Seminar



Monday, September 10th, 2018

1345 HSLC ~ 4:00 P.M.



Boris Gramatikov, PhD

Assistant Professor

Ophthalmic Instrumentation Lab

Wilmer Eye Institute

Johns Hopkins University School of Medicine

Utilizing the Birefringent Properties of the Human Fovea in the Design of Ophthalmologic Diagnostic Instrumentation

Our laboratory has been developing novel technologies for Retinal Birefringence Scanning (RBS) - a technique that uses the changes in the polarization state of light returning from the fundus to detect the projection into space of the radial array of birefringent Henle fibers surrounding the fovea. This allows eye tracking and detection of central fixation using anatomical information directly from the fovea, in contrast to other eye tracking methods that employ less accurate pupillary light reflex methods. In a binocular setting, RBS allows precise checking for eye alignment, which is important in testing/screening for amblyopia ("lazy eye"), a major health problem.

The talk focuses on two major applications: 1) a pediatric vision screener, and 2) a fast combined system where RBS technology is guiding the data acquisition and/or analysis in an OCT system (in collaboration with Duke University), also for pediatric applications. Both projects include design optimization using computer model of polarization-sensitive systems (including Mueller matrix modeling, Poincare sphere representation, etc), particularly with the goal of minimizing the influence of corneal birefringence. Special attention is paid to practical issues such as noise reduction; speed of data acquisition, analysis and central fixation detection; decision making logic; attention attraction methods; detection of ocular focus/defocus; laser safety, etc. Possible implementation of no-moving-part technologies will also be discussed.

Biography

Boris Gramatikov obtained his *Dipl.-Ing.* degree in Biomedical Engineering from the Technical University of Ilmenau, Germany, and his Ph.D. from the Technical University of Sofia, Bulgaria. He has completed a number of postdoctoral studies in Germany, Italy and the United States. He joined the faculty of The Johns Hopkins University in 1996, and works in the Laboratory of Ophthalmic Instrumentation Development since 2000. He is an active member of the IEEE, having chaired the Baltimore Section in 2006, being the Section's Director for Continuing EE Education since then, and a member of the Continuing Education Committee of the IEEE. Dr. Gramatikov's areas of expertise are electronics, optoelectronics, biophotonics, ophthalmic optics, computers, computer modeling, signal/image processing, and electronic instrumentation design, all applied to the development of diagnostic methods and devices for ophthalmology and vision research. His team has developed a series of pediatric vision screeners. Along with Dr. Cynthia Toth from Duke University, Dr. Gramatikov is the co-PI on a project for combining optical coherence tomography with retinal birefringence scanning, to enable and optimize OCT imaging in toddlers and young children. He has over 120 publications, 37 of which in high-impact peer-reviewed journals, h-index of 15. He serves as a reviewer and editorial board member with a number of technical and medical journals.

1345 Health Sciences Learning Center (HSLC) 4:00 - 5:00 P.M.