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Introduction

Light and photonics can influence our lives today in several ways that we could never have imagined a few decades ago. Light will play an even more significant role in the future, enabling a revolution in communications, nanophotonics, biophotonics, biotechnology, optical sensing, and lighting. Photonics is the field of science and engineering encompassing the physical phenomena and technologies associated with the generation, transmission, manipulation, detection, and utilization of light. Areas of major importance in photonics for the future are optics in information technology and telecommunications, optics in health care and life sciences, optical sensing, lighting, energy and optical systems for sciences.

Applications include adaptive optics for earth-based astronomy, infrared sensors for remote controls, to night-vision equipment. In the area of military applications, optical and photonic technology is ubiquitous, from photonic components to complex systems. Lasers are used for targeting, range finding, navigation and imaging. Infrared cameras provide satellite pictures of clouds. Infrared detectors are used for home security, real-time measurements of industrial emissions, on-line industrial process control, and global environmental monitoring. In biophotonics, optical techniques are under investigation for non-invasive diagnostics such as for example early detection of breast cancer. Optics is providing new biological research tools for visualization, analysis and measurement. Innovative optical sensors are augmenting human vision, revealing details and information never seen before. Improvements in photovoltaic cells will affect energy and environmental concerns on an international scale.

With a highlighted focus on scientific and engineering challenges in modeling, plasmonics materials, biophotonics optics, quantum communications and complex systems for sciences of the universe, OCS 2011 was held in Marseilles in September 2011. Outstanding keynote speakers were invited in four areas in which photonic and optical technologies are applied to innovate and enhance the future: biophotonics and biomedical optics, photonics for safety, security and environment, quantum communication and processing, and optical systems for sciences of the universe. The main purpose of this symposium was to bring together researchers involved in various experimental and theoretical studies on photonics and optics.

These proceedings comprise the refereed papers presented at this very stimulating meeting and present an up-to-date survey of many aspects of photonics. The contributions contained in these proceedings include those from leading experts on modeling of the optical properties of randomly rough surfaces, metamaterial, inhomogeneous, and plasmonics materials, and quantum communication. It is interesting to note that the first rigorous resolution

of the reduced Rayleigh equation for two-dimensional randomly rough surfaces is described. Recent applications of nanostructured materials, thin films, and advanced algorithms for complex optical systems for safety, security, and environment are also given in these proceedings.

We hope that these papers on very fascinating phenomena written by those involved today in the different subjects presented during the symposium will encourage other researchers to tackle these stimulating theoretical and experimental problems, and these proceedings will be of interest and a valuable reference for those studying photonics and optics.

I wish to thank the authors for the care they have put into the preparation of their contributions.

Gérard Berginc