

Optical Science and Engineering in Finland

Seppo Honkanen
Nokia Research Center
P.O. Box 45
00211 Helsinki, Finland

Finland, located between Sweden and Russia, is one of the world's northernmost countries. She has a population of about five million, with a population density of only 16/sq. km. Industrialization in Finland started in the late 19th century, making use of the rich natural resource of Finland's forests. Presently, Finland has become one of the world leaders in forest-based industries. The metal industry, especially shipbuilding, has also been very strong in Finland. However, in the past 20 years, the structure of Finnish industry has changed rapidly and has concentrated more and more on high-technology products and systems, such as the fields of electronics and telecommunications. In fact, the share of high-technology products is presently around 30% of Finnish exports. Research and development in Finland is carried out in a very close collaboration between industry, universities, and several laboratories of the Technical Research Center of Finland (VTT). Also in recent years, Finland has very actively participated in European research programs, even though Finland has been a member of the European Union for less than a year, since the beginning of 1995. Finnish scientists have also had very fruitful contacts and collaboration with groups outside Europe, e.g., in North America and Japan. Research and development in the broad field of optical science and engineering is also very active in Finland. In this editorial I will give a very short overview of these activities in Finland.

A great deal of the research in optical science and engineering is carried out in the area of Helsinki, which is the capital of Finland and is located on the south coast. The Helsinki area also includes the cities of Espoo and Vantaa. In this special section, 12 of the 20 papers are from the Helsinki area. At the University of Helsinki (HU), a very strong group on theoretical quantum optics is directed by Professor Stig Stenholm. Other activities of HU include laser spectroscopy. At the

Helsinki University of Technology (HUT), there are several very active groups in the fields of semiconductor optoelectronics, laser spectroscopy, diffractive optics, optical metrology, and optical waveguide theory. At Espoo, the photonics group of the Technical Research Center of Finland (VTT), headed by Dr. Matti Leppihalme, has been active on guided-wave optics for about 20 years. This work has led to large volume manufacturing of optical fibers at Nokia Cables Ltd. at Vantaa. Research at the universities and at VTT in the Helsinki area has resulted in spin-off companies or new optoelectronic products for companies. One example of industrial high-technology activities is the manufacturing and development of thin-film electroluminescent display devices at Planar Inc. at Espoo.

There are two centers of optical science and engineering outside the Helsinki area. In Joensuu, a city in eastern Finland, the research activities of the Physics Department of the University of Joensuu are focused on optics. Research topics include diffractive optics, optical material science, and nonlinear optics. The research groups of Joensuu provide two contributions in this special section. Major activities in the field of optoelectronic instruments are in Oulu, a city not far from the arctic circle. The groups at the University of Oulu and the Optoelectronics Department of VTT form a strong center of optoelectronics. Research is focused on development of optoelectronic equipment for instrumentation and sensor applications. A good example of the equipment that has been developed is the laser rangefinder based on the time-of-flight method. In Oulu, the contribution of Professor Risto Myllylä to optoelectronics research has been substantial, and this research has led to new industrial products and spin-off companies. In this special section, there are four articles from the groups in Oulu.

The region of Tampere, a city some 200 km northwest of Helsinki, has a few important groups in the field. At Tampere University of Technology, an internationally recognized group on semiconductor optoelectronics is directed by Professor Markus Pessa. Other activities in Tampere include optical techniques for chemical sensors, which are developed at the VTT. In this special section, there are two papers from Tampere. Important research on optics is also carried out in Turku, a city located on the southwestern coast of Finland. At the University of Turku, research topics include Fourier transform spectroscopy.

To conclude, it has been a great pleasure to have the opportunity to introduce the activities in Finland in the field of optical science and engineering. I wish to express my sincere gratitude to all the authors and reviewers for their helpful collaboration. The help received from the editorial staff of *Optical Engineering* has been invaluable. I also wish to thank my colleagues Matti Leppihalme, Ari T. Friberg, and Ari Tervonen for their help during the course of this project.



Seppo Honkanen received his DiplEng and DrTech degrees in 1984 and 1988, respectively, from the Department of Electrical Engineering at the Helsinki University of Technology, Finland. From 1984 to 1988 he was a research scientist at the Semiconductor Laboratory of the Technical Research Center of Finland. In 1989 he joined Nokia Research Center, Finland, as an R&D manager. There he started an integrated optics group developing glass

waveguide devices for optical communications. The project at Nokia led to the foundation of an integrated optics company, Optonex Ltd., in 1991. From 1991 to 1993, he was an invited researcher at the photonics group of Montreal (Ecole Polytechnique, Montreal, Canada) developing integrated optical devices for optical communications. He is presently a principal scientist at Nokia Research Center, Finland, with specialization in optoelectronics, and a docent of optical communications at the University of Joensuu, Finland. Dr. Honkanen has written two book chapters and is an author of more than 100 international articles and patents in the fields of integrated optics, optical fibers, optical communications, and optical interconnections; he has given several invited talks in these areas. He is a member of SPIE and OSA.