Photonic Integration: what, where, why, when, how?

Meint K. Smit

Institute for Photonic Integration, TU Eindhoven, The Netherlands
e-mail: M.K.Smit@tue.nl

The twentieth century is sometimes referred to as the century of electronics. The twenty-first century could well be the century of photonics. In other words the century of light but then light used in technical applications such as screens, solar cells, LED lighting, optical communication, 3D printers, medical diagnostics, metrology and sensors. The market for photonic technology is currently about one fifth of the global market for electronics but it is growing faster and Europe has a strong position in this market. Electronics and photonics can be found almost everywhere but electronics is currently further developed and relatively cheaper, especially due to the emergence of microelectronic and nanoelectronic integration technology. In photonics, integration technology is still in its infancy but it is developing rapidly.

Integrated optical chips are the optical counterparts of microelectronic integrated circuits. Electronic equipment used to consist of a box or a cabinet full of electronic components such as vacuum tubes, resistors, capacitors and coils. After the invention of the transistor, electronics became more compact and circuits that were not too big could be integrated on a single print plate. However the real breakthrough came in the 1960s and 1970s when a growing volume of electronics could be integrated in a piece of silicon with dimensions of just a few millimetres. In photonics we are now in the same situation as the initial years of microelectronics. Most optical systems still consist of separate components such as lasers, modulators, detectors and filters, which are connected to each other with lenses or glass fibres or plastic fibres. However the technology to integrate tens to hundreds of optical components on a small piece of semiconductor material, an optical chip, has made considerable progress in the past twenty years. In the lecture an overview will be given of where we are presently.