of the order of nanometers in mid-infrared and a mode spacing of the order of micrometers. Theoretical results are discussed in view of experimental data.

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Tunable photonic structures based on grooved silicon-on-insulator and liquid crystals

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This presentation is mainly focussed on the design, fabrication and characterisation of the ordinary and tunable photonic devices based on grooved silicon-on-insulator (SOI) structures and serving as one-dimensional (1D) photonic crystal. Depending on the lattice parameter, the structures possess not only a main photonic band gap in the region of 10-20 µm, but also a number of secondary band gaps extended to the near infrared range of spectra. The advantages of these photonic structures are as follows: the large refractive index contrast, in-plane moulding of the light flow, the possibility to fabricate a composite photonic structures by filling the grooves with a different compounds and compatibility with current semiconductor processing techniques. The optical properties of grooved (110) and (100) SOI structures were simulated using a transfer matrix method and band diagram method and have been verified experimentally using FTIR microscopy and fibre-coupling setup. The air spaces in the basic silicon-air matrices were infiltrated with nematic liquid crystals. It is shown that the optical properties of the obtained composite 1D photonic crystals (including micro-cavity structure) can be tuned by means of electro- and thermo-optical effects. Such a structures suit well for the various elements of the integrated optics and can serve as a building blocks for optical interconnects.

Towards SiGe quantum cascade lasers

D. J. Paul, Univ. of Glasgow (United Kingdom)

New designs for SiGe THz waveguides allows waveguide losses as low as 2 cm-1 at 3 THz while the total losses become 16 cm-1 when free carrier absorption and mirrors are added to a ridge waveguide laser. Results from Si/SiGe bound-to-continuum quantum cascade emitters will be presented operating between 2 and 10 THz where Monte Carlo modelling suggests gain up to 16 cm-1. The key to significant gain in such systems is the requirement to strain the light-hole states higher in hole energy than the heavy-hole radiative subband states. The design and growth issues in realising such bound-to-continuum active regions will be discussed with the experimental results from 5 different designs presented. The prospect for lasing will be reviewed especially with regard to the present key areas of bound-to-continuum design, total active layer thickness, waveguide designs and losses along with heterostructure layer quality.

Building technology platforms and foundries for photonic integrated circuits in Europe

R. G. Baets, Univ. Gent (Belgium)

No abstract available

Waveguides and devices: modelling

T. P. Felici, Photon Design (United Kingdom)

No abstract available

6996-50, Session 12

Photonics in the BREAD roadmap

P. Van Daele, Univ. Gent (Belgium)

No abstract available

6996-51, Session 12

Optical buffering scheme based on two-ring resonator system

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Optical buffer stores and holds optical data stream for a fixed duration without conversion to electrical format, an important role in all optical information processing. Slow light schemes based on optical resonator have been proposed ranging from arrays of side-coupled resonators (SCISSOR), coupled resonator optical waveguides (CROW) to the optical analogue of electromagnetically induced transparency (EIT). The most important parameter of optical buffer is the delay-bandwidth product (DBP) which denotes the amount of bits that can be buffered. Generally the DBP for the slow light schemes above is less than 1, meaning that a cascade configuration is necessary to buffer one or more bits. Furthermore the non-uniformity of delay and amplitude response over the spectrum gives rise to higher order dispersions, which accumulates along the cascade and distorts the signals and therefore limits the maximum buffering time.

We propose a scheme based on two-ring resonator system that exhibits both reasonably flat transmission and delay response with DBP larger than 1, and respectively is 4 and 3 times larger than CROW and SCISSOR. Simple time domain simulation shows that for buffering 4 bits without distortion on a given input stream, our scheme requires only 18 modules as compared to CROW and SCISSOR that require 54 and 78 modules respectively. This comparison is in good agreement with the ratio of DBP for each scheme. Moreover, comparison with SCISSOR shows that our scheme is more immune to higher order dispersion and can buffer twice longer before the inter-symbol interference becomes apparent.

6996-52, Session 12

Impact of large-scale reconfigurable optical interconnection networks in multiprocessor systems

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Metallic connections on printed circuit boards, as the standard way to interchange data between processors and memory modules in large-scale multiprocessor machines, are running into several physical limitations. Although recent developments of interprocessor communication technologies can deliver high data throughputs, it is widely recognized that replacement technologies will be required in the near future.

Optics is a great candidate to introduce fast interconnection networks in the architecture of multiprocessor systems. Using optical interconnects at short lengths, we can expect an increase in connectivity, higher communication bandwidths and data-transparent reconfiguration of the network topology, allowing for splitting, combining and repositioning the communication channels.

We investigate in this work how a practical reconfigurable optical network can be incorporated into distributed shared memory (DSM) machines, and determine the potential speed improvements one can obtain by rearranging the interprocessor communication topology even when the limits associated to opto-electronics are included. We find that for 16 processors connected in a torus topology, reconfigurable interconnects with switching speeds in the order of milliseconds can provide up to 20% reduction in communication delay. For larger networks, up to 64 processors, the expected gain can rise up to 40%.

We also present in this paper the optical elements for a possible implementation of the reconfigurable network, based on the research done previously over each of these components. Fiber holders, along with focusing diffractive microlenses, a broadcasting prism and its corresponding micropositioning devices are described in detail.

Technical Programme

SPIE Europe Photonics Europe

Conferences: 7–10 April 2008
Exhibition: 8–10 April 2008
Industry Perspectives Programme: 8–10 April 2008

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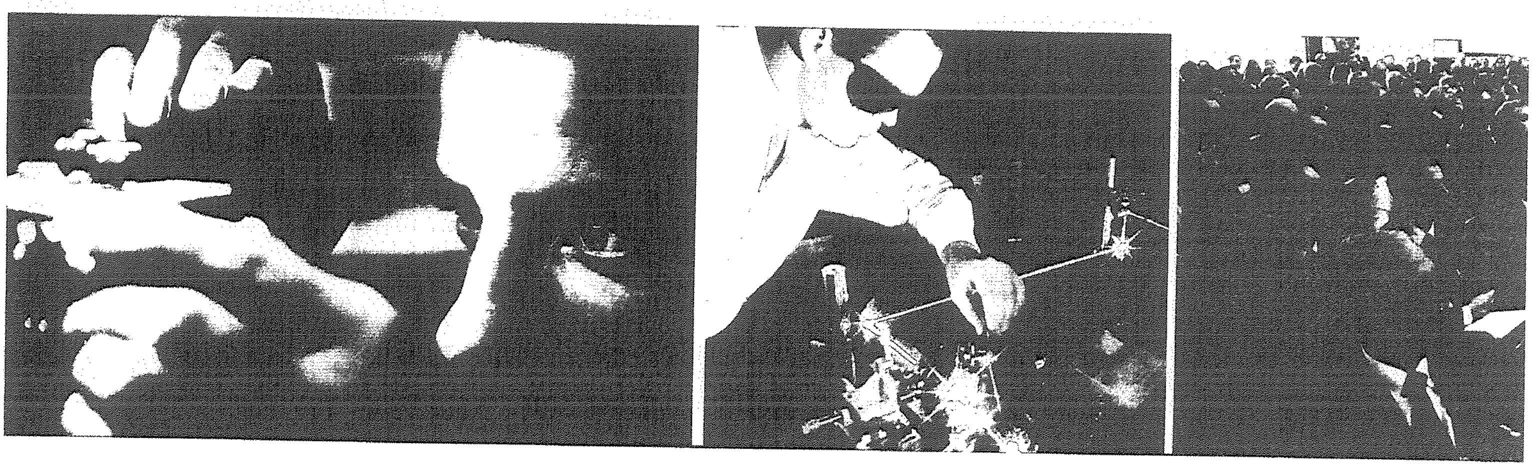

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