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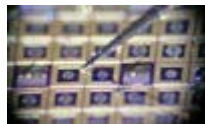
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MEMS make SOAs tune farther and faster

17 August 2004

Pioneers of vertical-cavity semiconductor optical amplifiers (VC SOAs) tout these next-generation devices as a low-cost alternative to erbium-doped fibre amplifiers and in-plane SOAs for metro and access networks. They cite benefits such as low power consumption, high fibre-coupling efficiency, polarization-insensitive gain and compatibility with on-wafer testing.



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What's more, the device's narrow amplification bandwidth means it can operate as an amplifying filter, in which a single channel is amplified while out-of-band noise is removed. And now, researchers at the University of California, Santa Barbara, US, have taken things further by incorporating a microelectromechanical systems (MEMS) element to create a VC SOA with an 11 nm tuning range.

The research team formed the tunable VC SOA using an indium phosphide-based active region sandwiched between two aluminium-gallium-arsenide distributed Bragg reflectors. Applying a voltage to an overlying MEMS membrane tunes the amplification wavelength. The device exhibits more than 10 dB gain between 1580 and 1569 nm and has a peak gain of 17 dB at 1570 nm. The gain level is wavelength-dependent, but may be held constant across the tuning range by adjusting the optical pump power.

"Adding wavelength tunability allows the VC SOA's peak gain to be precisely adjusted to match the signal wavelength," said researcher Garrett Cole. "This is particularly useful in low-cost optical networks where the lack of temperature control may cause signals to drift over a fairly wide wavelength range. Also, by developing widely tunable VC SOAs it may be possible to selectively isolate and amplify individual channels in a multiwavelength system."

Previous attempts at tuning VC SOAs via temperature control were hampered by a slow response (of the order of milliseconds) and a tuning range of just a few nanometres. MEMS-based electrostatic tuning, on the other hand, enables tuning speeds of a few microseconds, as well as a wavelength range of tens of nanometres. In addition, electrostatic tuning consumes little power due to low current requirements (in the nanoamp range) and does not need external components.

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The team is now revising the mechanical design to cut the tuning voltages and extend the wavelength range. "We would also like to look into updating the optical cavity design to develop devices with a more constant gain profile over the achievable wavelength span. And we will be developing electrically pumped devices," said Cole.

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