National Aeronautics and Space Administration

Surface Emitting Lasers Improve Communications

Optical communications in terrestrial environments and space require very high frequency transmitted signals, on the order of 40 GHz and higher, because of the uncertain and changing transmission environments. A robust communications system is needed that will provide these frequencies and substantial discrimination between different signals, which permit switching times on the order of 0.25 picoseconds, and that permits the use of two or more distinct signals. The Vertical Cavity Surface Emitting Laser (VCSEL) array has been developed by NASA to use external modulation of light from two or more coherently coupled VCSEL lasers to provide a very high frequency, fast switching outbeam for terrestrial and/or space communications.

This invention is available for licensing from NASA's space program to benefit U.S. industry.

Patent

NASA-owned technology protected by U.S. Patent No. 7,333,735
(Reference No. ARC-14682-2)

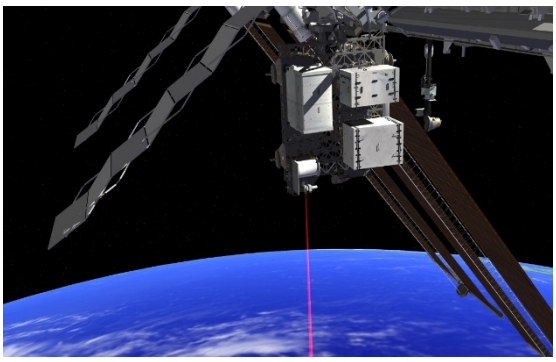
Benefits

- Reduce overall volume of an interconnect network
- Ultrafast optical networks at higher frequencies
- Provides substantial discrimination between different signals
- Fast switching output beam
- Permits the use of two or more distinct signals

Technology Details

The embodiment of this invention includes application of an array of VCSELs spatially coupled together. A current source is connected to the VCSELs, with a steady current biased above threshold current, where the coupling of the VCSELs produces an output laser beam having a spatial oscillation. A switching device is used that transfers the near laser field emitted by two or more coupled VCSELs to two receivers where external modulation is then used. Another embodiment produces a far field device where two VCSELs produce an output beam that is also received and processed by an external modulation system. The resulting far field pattern has two lobes that oscillate out of phase and are useful for beam switching. Dynamic beam switching of VCSELs has important applications for switching and routing in optical interconnect networks. This invention is based on computer simulations of the light output of an array of two or more coupled VCSELs. The model equations that are solved on the computer are an approximation to the semi-conductor Maxwell-Bloch equations. The invention produces an optical data stream from an external modulator that receives an optical pulse train from an array of coherently coupled VCSELs.

Optical fibers



Laser communication

Commercial Applications

- Aerospace
- Atomic clocks
- Optical interconnect networks
- Fiber optic backplane receivers
- Telecommunications transceivers

Contact the Ames Technology Partnerships Office at 1-855-627-2249 or ARC-TechTransfer@mail.nasa.gov