Using Optical Solitons to Increase Figure-of-Merit of Laser Beam Deflection Devices

Technology #9895

Applications

The Inventors have developed a technique to increase the number of resolvable points of any laser beam deflection device by multiple orders of magnitude. This can lead to important advancements in numerous telecommunications and imaging applications in the medical, industrial and entertainment industries, among others. Specific applications include in-body imaging, all-optical computing, fast laser printing and 3D-laser TV.

Problem Addressed

Fast deflection of a beam of directed laser light by an arbitrary angle high important to optical telecommunications and imaging applications. Beam-deflection devices accomplish this task by shuffling signals from incoming fibers into outgoing fibers. The efficiency of this device, referred to as its “figure of merit,” is often evaluated by the number of the resolvable (addressable) points at its output. Currently available beam-deflection devices exhibit significant trade-offs between their speed and figure of merit. The Inventors propose to use optical solitions to increase the figure of merit of any beam-deflection device by many orders of magnitude.

Technology

Finite width laser beams diffract as they propagate in any linear media. In non-linear media, a spatial optical solition can form under certain conditions, and a beam may propagate through the material un-changed. In this way, a spatial solition generates a self-induced waveguide as it propagates; through non-linearity, the local index of refraction increases at the places where intensity is high. This non-linearly induced waveguide then in turn guides the beam which created the waveguide in the first place. This system makes the beams stable to small perturbations such that they can propagate for long distances, while perfectly preserving their initial shape.

The Inventors technique involves placing a non-linear medium at the output of a beam-deflection device such that any beam entering the non-linear media forms a solition. In this case the beam’s final angle of deflection is not influenced; however, the number of resolvable points at the output of the combined device increases by the ratio of the length of the non-linear material to its diffraction length when non-linearity is “turned off.” Practically, this may translate to an increase of four or more orders of magnitude.

Advantages

- Solition formation can increase the number of addressable points by four orders of magnitude
- Proposed device is small in size (~1cm in length) and can easily integrate with existing

255 Main Street, room NE 18-501
Cambridge, MA 02142-1601
Phone: 617-253-6966 Fax: 617-258-6790
http://tlo.mit.edu
Contact the Technology Manager: tlo-inquiries@mit.edu

systems
- Technology can be applied to both in-plane and 3D beam propagation

Categories For This Invention:

Photonics
Displays
Telecommunications

Intellectual Property:

Using optical solitons to increase figure-of-merit of laser beam deflection devices
Issued US Patent
7,027,681

Inventors:

Marin Soljacic
Mordechai Segev
Chiyan Luo
John Joannopoulos

External Links:

Photonics & Modern Electro-Magnetics Group
http://www.rle.mit.edu/marin/

255 Main Street, room NE 18-501
Cambridge, MA 02142-1601
Phone: 617-253-6966 Fax: 617-258-6790
http://tlo.mit.edu
Contact the Technology Manager: tlo-inquiries@mit.edu