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Diffused Guides for Distributed-Feedback Lasers

In optical communication systems currently under development, laser beams are conducted through fiber-optics lines (light pipes). To reduce coupling losses between the laser source and the light pipe, specially-configurated fiber-optic transmission line is used. This line is structured to amplify the light signal, forming in effect a distributed-feedback laser. As the beam progresses through the line, the periodically varying index of refraction scatters the beam. Thus, a chain of resonant cavities is formed without conventional mirror optics. One such pipe, incorporating periodically-spaced micromechanical notches, has been described in NASA Tech Brief B75-10127 (NPO-13531).

An alternate procedure is to use a diffused optical waveguide. The proposed waveguide is a hollow cylindrical pipe. Inside, the pipe forms a diffused channel, i.e., gas or metal molecules are infused into the channel walls by heating or other conventional means. Thus the channel surface is corrugated, forming periodic cross sections along the entire length. As the light is guided along the channel, it is scattered at the periodic infusions, resulting in distributed feedback. The high index of refraction at the wall causes the pipe to act as a waveguide and eliminates the losses by radiation.

The described configuration is particularly suited for capillary gas lasers. A similar half-channel (semicylindrical) guide can be constructed as an integrated optics element. Theoretical calculations have shown the feasibility of such light pipes operating in TE modes. These types of guides are relatively simple to fabricate.

Note:

Requests for further information may be directed to:

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Patent status:

This invention is owned by NASA, and a patent application has been filed. Inquiries concerning nonexclusive or exclusive license for its commercial development should be addressed to:

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