REVIEW OF THE STATUS OF OPTICAL FIBER TRANSMISSION AND INTEGRATED OPTICS

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Since the first low-loss fibers were reported in 1970, optical transmission research has focused almost entirely on the use of fibers. Earlier work on transmission via periodically focused beams had spawned the need for integrated optics -- using single-mode optical circuitry in miniature dielectric waveguides -- in order to make feasible multiple carrier transmission medium. In both of these two fields -- lightwave transmission on fibers and integrated optics -- there has been exceptional technological progress.

Glass fiber lightguides have losses as low as 2 dB/km and pulse dispersion less than one nanosecond per kilometer. In multimode fibers, sophisticated grading of the index of refraction from the axis to the cladding is required to achieve the least pulse broadening and ongoing research is still directed toward better understanding and better control. Some work has been done with single-mode fibers (which are quite feasible), but due to over-all system considerations, they are not likely to be in the first commercial applications.

Both LEDs and lasers are suitable for use as carrier generators, the LEDs with multimode fibers and lasers with either single-mode or multimode fibers.

The use of n separate fibers with n identical pairs of carrier generators and detectors provide n telecommunication channels. There is no need for complicated optical circuitry in this multichannel system. However, the integrated optics technology may prove valuable in making a laser-modulator combination.

The research on integrated optics has produced several techniques for pattern-formation of dielectric waveguides, and has yielded experimental components such as distributed feedback filters, modulators, and switches with excellent on-off ratio.

The potential applications of lightwave transmission on fibers includes many of the places where copper pairs or coaxials are now used -- on-premises links, interoffice trunks, customer loop service, and intercity trunks. The advantages of fibers include small size, freedom from induction noise or lightning surges as well as bandwidths well beyond 100 MHz if needed. Different fiber designs will be optimized for the different system objectives.

Many groups in the United Kingdom, Germany, Japan, as well as in the United States, are pointing toward commercial fiber transmission use, but no commercial service date has been announced.