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MITSUBISHI ELECTRIC DEVELOPS A BASCULE OPTICAL SWITCH CAPABLE OF CROSS-CONNECTING SIXTEEN OPTICAL FIBER PATHS IN WORLD RECORD SPEED

OSAKA, Feb. 17, 2004 — Mitsubishi Electric Corporation (President and CEO: Tamotsu Nomakuchi) has developed an optical switch for sixteen optical fiber paths, as part of an optical cross-connect system. The bascule optical switch structure, which mechanically connects and disconnects the optical fiber paths via a mass-produced polymer film, acts in less than one millisecond, a world record time for polymer waveguide switches.

The optical cross-connect system[1] is a key component of photonic networks, which manage communication signals in the optical layer. This technology is expected to expand the throughput of network nodes facing a bandwidth bottleneck caused by the electrical router. This new switch will provide excellent support to the development of metropolitan networks, which continue to expand as the demand for broadband communications increases.

[1] Optical cross-connect system: a network node management system that manages the optical path independent of the transmission data format, i.e. SDH (Synchronous Digital Hierarchy), SONET (Synchronous Optical Network), or Ethernet. The connection is managed by the GMPLS (Generalized Multi-Protocol Label Switching).

Background

Broadband communication has become increasingly popular in recent times. At present, the main mode of Internet usage is file transfer (downloading the required file from a web server), yet in the future, communication looks set to become considerably more real-time and bi-directional. Photonic networks, which manage the optical signal in the optical

layer without the help of an electrical overhead readout, are expected to feature strongly as metropolitan networks continue to expand. In order to enable this next generation network, Mitsubishi Electric has been developing a mechanical actuation structure that is suitable for the mass production of low insertion loss, and low cost bascule optical switches.

Main Features

1. Sixteen optical fiber paths cross-connected by polymer waveguides, with low insertion loss – a world first.

A two-dimension mechanical actuation array technology was developed for bascule structure movement. The optical cross-connect system manages sixteen optical fiber paths, and the optical waveguide paths are physically contacted, so that the optical connection loss is just 0.05dB/crosspoint (=1% loss). The total loss, including the other excess losses, is less than 10dB (=90% loss), which meets the requirement for optical cross-connect systems.

2. Polymer waveguides switching in less than one millisecond, the worlds fastest time

A miniaturized Piezo actuator array[2] switches the polymer films in less than one millisecond, the fastest time for a polymer waveguide cross-connect switch in the world. This performance satisfies the network requirement of less than 10 milliseconds. The network data loss during the connection is minimized, and a highly efficient network is now available.

[2] Piezo actuator array: two dimension array of micro mechanical movement by electrical voltage.

3. Mass-produced Polyimid adopted as a flexible polymer film

Polyimid is already well known as a material used for flexible printed circuits. Not only is it mass-producible, but it is also considered to have a high reliability and a low cost. Polyimid's properties make it ideal for optical waveguides and usage in the mechanical actuation structure.

Future Developments

Sample products of the bascule optical switch will be shipped in the September 2004. A small-scale start, with 8 or 16 fiber paths, will be sufficient for an optical cross-connect test-bed. Mitsubishi Electric expects to be an active participant in the next generation network test-bed with our optical cross-connect system, which complies with the GMPLS, a multipurpose control plane paradigm.

Patents Pending

Fourteen patents are currently pending for in Japan; seven patents are currently pending abroad.

About Mitsubishi Electric

With over 80 years of experience in providing reliable, high-quality products to both corporate clients and general consumers all over the world, Mitsubishi Electric Corporation (TSE: 6503) is a recognized world leader in the manufacture, marketing and sales of electrical and electronic equipment used in information processing and communications, space development and satellite communications, consumer electronics, industrial technology, energy, transportation and building equipment. The company has operations in 35 countries and recorded consolidated group sales of 3,639 billion yen (US$30.3 billion*) in the year ended March 31, 2003. For more information visit http://global.mitsubishielectric.com

*At an exchange rate of 120 yen to the US dollar, the rate given by the Tokyo Foreign Exchange Market on March 31, 2003.

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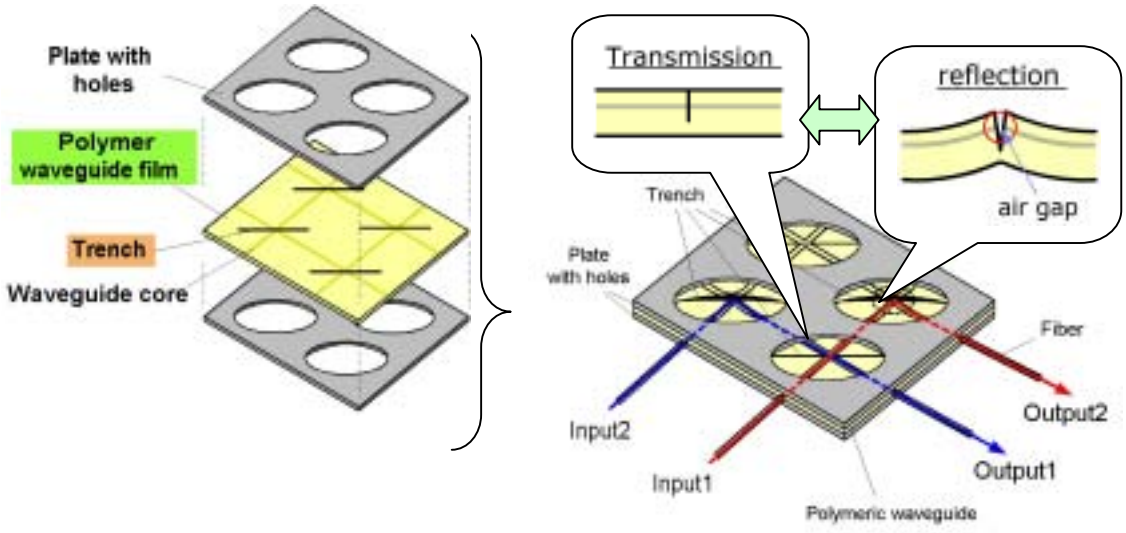
Appendix 1

Bascule structure

The Bascule structure mechanically switches on and off the waveguides according to the flexibility of the polymer film. Figure 1 shows the bascule structure. The flexible polymer film is sandwiched between two plates with holes. A trench is located at each waveguide cross point. The trench opens and closes depending on the mechanical push or pull. When the trench is open, the light input is totally reflected by the air gap and turns 90 degrees to the right.

Figure 1: Bascule structure



Appendix 2

Two-dimension array technology for mechanical actuation

A 16x16 matrix switch can only be made available if the precise two-dimension actuator array can be produced at a low cost. Figure 2 shows the structure of mechanical actuation structure. The cross-point is sandwiched by two balls. A push from below by the Piezo actuator causes the polymer film to open. A pull by the Piezo actuator will close the cross-point, relieving the force of the upper spring.

Figure 3 shows a photograph of a Piezo actuator array manufactured by NGK Insulators, LTD. Large-scale two-dimension arrays are mass-produced, in order that the two-dimension matrix integration of the bascule structure can be realized.

Figure 2: Mechanical actuation structure

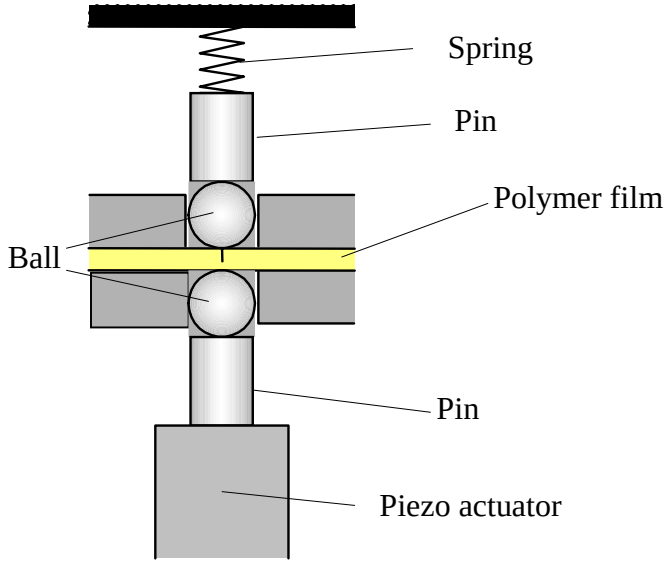


Figure 3: Piezo actuator array(Supplied by NGK Insulators, Ltd.)