

Approach to construction of optical signals switchboards, controlled by optical radiation

A.H. Sultanov¹, I.L. Vinogradova¹
¹ Ufa State Aviation Technical University

Abstract

This article is devoted to the study of the possibility of creating switches for optical signals controlled additionally by the applied optical radiation. It is assumed that the control radiation changes the refractive index of the optical medium of the device and the wavelength of the information radiation together with it. A multibeam interferometer is used to control the latter. Technical aspects of the device design are evaluated briefly. The analysis shows that the interference switch is technically feasible in theory. Its main disadvantages include the presence of a constant component in the interference pattern and distortion of the digital optical signal by interference and nonlinear optical effects.

Keywords: optical signals switchboards, optical radiation, radiation change, optical medium, interferometer, digital optical signal, nonlinear optical effects.

Citation: Sultanov AH, Vinogradova IL. Approach to construction of optical signals switchboards, controlled by optical radiation. *Computer Optics* 2004; 26: 56-64.

[Access full text \(in Russian\)](#)

References

- [1] Rules on design of power electric installations. Sixth edition, amended and revised by Glavgosenergonadzor of the Russian Federation [In Russian]. Saint-Petersburg: Dean Publishing House; 2000.
- [2] Ubaydullayev RR. Optic fiber networks [In Russian]. Moscow: "Eco-Trends" Publisher; 2000.
- [3] Matveev AN. Optics [In Russian]. Moscow: "Vysshaya Shkola" Publisher; 1985.
- [4] Sultanov AK, Usmanov RG, Vinogradova IL, Alkin YP. Reconstruction of a departmental network "Bashkirenergo" [In Russian]. *VKSS* 2002; 3: 60-69.
- [5] Burdin VA, Golovina OP, Platonov AA. Electrical discharge resistance of optical fibers. In Book: Proceedings of Russian scientific and technical conference of academic and engineering staff. Samara: PIIRS Publisher; 1996: 62.
- [6] Burdin VA, Golovina OP, Platonov AN. Simulation of the impact of pulsed electromagnetic fields on underground and aerial optical communication cables. In Book: Proceedings of the Ith Povolzhskaya scientific and technical conference on the problems of dual application. Samara: 1995: 94.
- [7] Dmitriev SA, Slepov NN, eds. Fiber-optics technology: history, achievements, prospects. Moscow: "Connect" Publisher; 2000.
- [8] Agrawal GP. Nonlinear fiber optics. Boston: Academic Press; 2000.
- [9] Becter PC, Olsson NA, Simpson JR. Erbium-doped fiber amplifiers. Boston: Academic Press; 1999.
- [10] Agrawal GP. Applications of nonlinear fiber optics. Boston: Academic Press; 2001.
- [11] Tikhvatullin RA, Vinogradova LE, Vinogradova IL, Rzhovsky SP. Fiber-optic splitter [In Russian]. USSR Inventor's certificate SU 1697035, MKI5 G 02 B 6/28 of December 7, 1991. *Russian Bull of Inventions* N45; 1991.
- [12] Tikhvatullin RA, Vinogradova IL, Vinogradova LE. Fiber-optic splitter [In Russian]. USSR Inventor's certificate SU 1760494, MKI5 G 02 B 6/28 of September 7, 1992. *Russian Bull of Inventions* N 33; 1992.
- [13] Sultanov AH, Yakubov TY, Vinogradova IL. Fiber optic amplifier. Pat RF of Invent N 2203502 of April 25, 2001.
- [14] Vinogradova IL, Sultanov AH. A statistical approach to the description of Fabry-Perot interferometers as elements of multibeam interference in communication lines [In Russian]. *Radiotekhnika* 2000; 1: 45-49.
- [15] Gowar J. Optical communication systems. Prentice Hall; 1993.
- [16] Vinogradova IL. Characteristics of two-resonator Fabry-Perot interferometer [In Russian]. *Radiotekhnika* 2002; 6: 33-37.
- [17] OST 45.104-97. Optical interfaces of synchronous digital hierarchy transmission systems [In Russian]. Industry standard. Moscow: "Informsvyaz" Publisher; 1997.
- [18] ITU-T Recommendation G.703. Physical/electrical characteristics of hierarchical digital interfaces [Un Russian]. Moscow: "Informsvyaz" Publisher; 1988.
- [19] Slepov NN. Synchronous digital networks SDH [In Russian]. Moscow: "Eco-Trends" Publisher; 2000.
- [20] Loshenkov AA, Vinogradova IL. Pump laser for EDFA amplifier in fiber optic communication line segment. Problems of engineering and telecommunication technologies. In Book: Proceedings of the Fifth international scientific and technical conference. Samara: PSUTI Publisher; 2004: 34-38.
- [21] Sultanov AH, Yakubov TY, Vinogradova IL. Fiber optic communication line segment containing amplifier EDFA [In Russian]. *Sensors and Systems* 2002; 4: 21-33.
- [22] Sultanov AH, Sharifgaliev IA, Kanakov VI, Vinogradova IL. Research of influence of nonlinear optical effects in fine-grained glasses on the transmitted pulse signal [In Russian]. *Vestnik USATU* 2004; 1: 24-31.
- [23] Sultanov AH, Kanakov VI, Vinogradova IL. Nonlinear optical effects in fiber optic components based on deformed glasses [In Russian]. *Infocommunication Technologies* 2003; 2: 47-52.
- [24] Gusev AI, Rempel AA. Polycrystalline materials [In Russian]. Moscow: "Fizmatlit" Publisher; 2001.
- [25] Valiev RZ, Alexandrov IV. Nanostructured materials produced by severe plastic deformation [In Russian]. Moscow: "Logos" Publisher; 2000.

- [26] Sultanov AH, Usmanov RG, Vinogradova IL. Segment of a synchronous network with signal recovery without optic-to-electronic transduction [In Russian]. Ufa: "USATU" Publisher; 2002.
- [27] Usmanov RG. Research of multiphoton absorption and parametric generation in a segment of a synchronous network with an erbium amplifier [In Russian]. In Book: Radiolocation, navigation, communication: Proceedings of the International scientific and technical conference RLNC'2002. Voronezh: "NPF Sakvoe" Publisher; 2002: 1221-1230.
- [28] Zhabotinsky ME, ed. Quantum electronics: a small encyclopedia [In Russian]. Moscow: "Sovetskaya Encyclopedia" Publisher; 1969.
- [29] Sivukhin DV. General course of physics: Optics. Moscow: "Nauka" Publisher; 1980.
- [30] Gibbs HM. Optical bistability: controlling light with light. Orlando, FL: Academic Press; 1985.
- [31] Burdin VA. Model of piecewise-regular fiber optic transmission lines of communication networks [In Russian]. Moscow: "Radio i Svyaz" Publisher; 2002.