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Abstracts

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BISPIN-BASED OPTOELECTRONIC NEURON ELEMENT

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The study of the collective behaviour of neural network and the individual behaviour of the single neurons in the network may effectively be conducted using the realistic model of the biological neuron. Such a model should possess as many characteristics of the real neuron as possible, and its hardware implementation should be highly integrated for creation of large neural networks. We propose a BISPIN-based optoelectronic neuron element with frequency inputs and outputs [1], that resembles a behaviour of the biological neuron, having such characteristics: valley activity, spatial summation, time summation, strength-duration rule, phase of absolute and relative refractivity, liability, transformation of the rhythm, dependence between frequency and amplitude of rhythmic excitation, accommodation. BISPIN integrates input signals, it has an adjustable threshold, which can be controlled either optically or electronically, and is a generator of frequency-encoded impulses with a constant amplitude [2].

Keywords: BISPIN, neuron element models, neural processing, neural networks

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PHASE RADIO-OPTICAL TRANSFORMERS

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The exposition phasefrequencies methods of transformation of complete phase decrusions in radiooptical measuring systems are given. For transformation of phase relations from a radio-frequency range in optical the double optical-acoustic modulation in a mode of the Bregg diffraction is used. The block diagrams calibrators of phase decrusions with use are given as a specifying device a relative frame acoustic-optical modulator. On the basis of use of a principle of a phase ring designed comparator of linear angular travels. The plan, photo and characteristics electronic phasemeasuring system for laser phasemeasure and interferometry is given.

Keywords: Phase measuring, radio-optical transformers, accusto-optical modulator, phasemeasure, and interferometry.

THERMAL PROCESSES FEATURES IN MICROLASER SYSTEMS

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The integration of optical transmitters and receivers results in reduction of sizes increase of an amount of elements in self-contained volume and increase of heat development in a unit volume. Despite of record efficiency of transformation electrical energy in optical, which reach about 70 %, and out of a considerable proportion of optical energy through fiber, optical emitters are essential sources of heat. Thus, the temperature conditions of semiconducting lasers not only determine information and operating performances of devices, but also possibility of their technological and functional integration. With reference to stabilization problem of microlaser devices, it is possible to select following physics and technological levels of creation and operation:

1. The atomic-molecular level, where one is taken into account interaction of electrons with phonons of a crystal lattice and its effect on quantum yield of radiation and absorption of energy by lattice atoms. This level determines the source of development of heat will be derived;

2. The circuit level, on which one is taken into account thermal effects on circuit components;

3. The instrument level, where removal problem of a heat from sources is decided.

4. The system level ofthermostabilisation of performances of microlasers and systems. The solutions can be realized at a nuclear level, thermal and cybernetic with use automatic regulating system.

The thermal model of emitter is developed, where the optical channel for removal of energy is entered. The model allows determining requests to design of integrated structure and optical unit of radiation input into fiber.

The recommendations for development of microlaser devices:

- *Laser chip heat generation reduction* by optimization of its atomic structure with consideration of absorption and emission of photons and phonons: the hot-carriers are to be placed in cold zones

- *Optical power loss reduction* in the transceiver by optimization of output subsystem construction of optical radiation into fiber;

- *Effective heat extraction* from the laser and other heating elements by application of microcoolers such as TEMC and thermal microtubes;

- *Application of control loops* including mismatch sensor and independent circuits of stabilization by optical, electrical and thermal modes.