Similar to this are conventional optical singularities (vortices, polarization singularities). Poynting vector singularities may be combined into corresponding networks which topologically define the qualitative behavior of the Poynting vector or the characteristics of the energy flows. Therefore, the study of energy flows, the behavior of Poynting vector, and its singularities is an important theoretical and experimental task. It should be noted that direct measurement of Poynting vector characteristics is impossible. At the same time, under paraxial approximation, the characteristics of this vector may be constructed on the basis of data of local Stokes polarimetry and interferometry of electric field components.

It has been shown that under paraxial approximation the Cartesian components of the Poynting vector can be written as follows:

The terms in square brackets of the first and second equations define structural (or orbital) transversal currents of field energy. Namely, these terms are responsible for appearance of orbital momentum in the area of vortex (scalar field), or in the area of the C-point (heterogeneously polarized field). The last terms in the expressions of transversal components are responsible for the spin energy currents, which define the spin angular momentum of the field. Such energy flows are defined only by polarization characteristics of the field. Namely such currents are the cause of the arising of field spin momentum in smooth beams like elliptically polarized Gaussian beam.

Thus, the Poynting vector components are defined by the Stokes parameters and the derivatives of the component phases. It should be noted that only one component (to be specific, the y-component) is required for the interferometry, because the phase of the other component is defined as $\Phi_z = \Delta + \Phi_y$ where Δ is the local phase difference between orthogonal components, which may be obtained from the values of Stokes parameter. In other words, all values in Eq. (1) may be measured by the methods of local Stokes polarimetry and interferometry of the electric field orthogonal components.

Gutsul O.V.

THE RHEOLOGICAL AND ELECTRICAL PROPERTIES OF POLYMER-COLLOID SOLUTIONS

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Over the last decade, there has been a growing attention of scientists in the study of polymer-colloidal dispersions with particle sizes up to 100 nm. This, in turn, is due, first of all, to the possibility of their use in various fields of science, in particular in medical, pharmaceutical and others. Nanodispersions are usually quite unstable, so the urgent task is to obtain stable nanodispersions with reproducible properties. The most promising is the stabilization of macromolecules of natural and synthetic polymers. Non-conductive and conductive polymers are used to create polymer composite materials. Particularly noteworthy are artificial polymers, that is, natural polymers that are modified by chemical treatment. For example, cellulose can be modified into diacetylcellulose, carboxymethylcellulose (CMC) or methylhydroxyethylcellulose, and the like. Such polymers are used as a matrix or as an auxiliary component to create composites. At present, various nanoscale powders are used as a starting object for the creation of composite materials, the use of which is promising in the aspect of creating new materials with unique characteristics, as well as for modifying existing ones. The very study of the effect of nanoparticles on the change in the properties of polymers is extremely important for the development of technologies for working with polymer-liquid crystal composites. The physicochemical properties of heterogeneous and homogeneous media are determined not only by the parameters of the system components, but also by their interaction, which leads to a reorganization of the system and to changes in the processes that occur in them. The basic physicochemical properties of CMC particles in aqueous solutions are known and the CMC particle sizes (particle radius, diffusion layer thickness, and molecular weight), solution viscosity, and molecular weight of the polymer (EY Shachnev et al., 2014). The viscosity of solutions containing macromolecules is usually higher than the viscosity of solutions of low molecular weight compounds and colloidal solutions of the same concentration (A.S. Turaev et al., 2008; I.E. Stas' et al., 2015; Zobov K.V., 2017). The problem remains to study the rheological, structural and mechanical properties of polymers aqueous solutions in the presence of metal and semiconductor nanoparticles, since it is the rheological properties that are most sensitive to changes in the molecular structure of polymer matrices and their complexes. It is characteristic of nanoscale objects that due to their special interaction with the medium, even small additives of nanoparticles to the composite, can significantly improve its mechanical properties, such as strength, adhesion, hardness, fluidity and viscosity, in particular, it is shown that the increase concentration and reduction of particle size leads to an increase in the viscosity of the polymer-colloidal solution. It is established that nanopowders of silicon dioxide of different sizes dramatically affect the viscosity of liquids (Zobov KV, 2017).

The primary task in the aspect of composite materials is to analyze the mechanisms of influence of nanoparticles on the physicochemical parameters of polymer-colloidal solutions in order to identify the factors that differentiate the types of nanopowders.

Ivanchuk M.A.

SEPARATING OF TWO NORMAL DISTRIBUTED RANDOM VARIABLES BY USING THEIR STREWNFIELD

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We consider two sets A and B in two-dimensional Euclidian space R^2, which are generated by normal distributed random variables ξ,η with parameters μ_ξ,Σ_ξ and μ_η,Σ_η accordingly. The ε-separation problem is the problem of finding the line which separates space R^2 into subspacesH^+ and H^- such as $P\{\xi \in H^+\}+P\{\eta \in H^-\}<\varepsilon$.

Suppose $\varepsilon_\xi n_A + \varepsilon_\eta n_B \le \varepsilon\ (n_A+n_B)$. Then ε-separation problem is considered as the problem of finding the line, which separates space R^2 into subspacesH^+ and H^- such as $P\{\xi \in H^+\}<\varepsilon_\xi$ and$P\{\eta \in H^-\}<\varepsilon_\eta$.

If sets A and B are equivalent, one can take $\varepsilon_\xi=\varepsilon_\eta=1/2\varepsilon$. In the case of medical forecasting, if it is necessary to separate the set of patients with the presence of pathology (set A) and without it (set B), in order to maximize the sensitivity of the test, the ε_ξ should be minimized, and if necessary to increase the specifity of the test, the ε_η should be minimized.

We construct the strewn field $B_{\varepsilon\xi}$ of the probability $1-\varepsilon_\xi$ for the random variable ξ. The probability of a random variable being outside this strewn field is equal to εξ. Similarly, we construct the strewn field B(εη) for a random variable η. Then, if the strewn fields B (εξ) and B (εη) are separable, the sets A and B are ε-separable, and the separating line for the strewn fields B (εξ) and B (εη) is ε-separable for the sets A and B.

So, the problem of ε-separability of two sets, which are generated by the normal-distributed random variables can be reduced to the task of separability of this random variables' strewn fields.

Makhrova Ye.G.

DEVICES FOR SURGICAL TREATMENT OF FRACTURES AND DAMAGES OF LONG BONES

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In operative treatment of fractures and damages of long bones bone-surface osteosynthesis is widely used, as the cheapest, accessible type of osteosynthesis. The use of this type of osteosynthesis is associated with a number of problems that arise in the further use of the fixator.

Existing bone-surface device structures, as a rule, are, in most cases, single-leafed. They unsatisfactorily resist bending deformations of the frontal plane, as well as – deformations of torsion. In addition, such sketch structures should be quite massive, as they should provide a