Thus, on the basis of the obtained results, the following conclusions can be formulated: C-points can be obtained due to the superposition of two orthogonally linearly polarized waves; the sign of the topological indices C-points alternate in the transition from one to the adjacent period of superposition; the sign of topological index of C-point is defined by direction of increasing of intensity changes of one of the waves and the phase difference between interfering beams.

Ivanchuk M.A.

NON-LINEAR CLASSIFICATION PROBLEM SOLVING

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There are many algorithms for solving linear classification problems, the most well-known of which are the linear discriminant analysis and the Bayesian classifier. The tasks of the nonlinear classification are more difficult to solve, since each specific task requires its approach. For example, using the Support Vector Machine, the quality of classification depends on the correctly selected kernel. We offer our own approach to nonlinear classification problems solving.

Let the training sets of points *A*, *B* are given in the Euclidean space R^d. The task is to create a classifier that divides the sets *A* and *B* with a predetermined significant level ε. Consider the case when the sets *A* and *B* do not intersect, but the convex hull of the set *A* lies inside the convex hull of the set *B*.

Let $k = 2$. We conduct a cluster analysis by the *k*-means algorithm for the sets *A* and *B*. Let's separate each of the sets *A* and *B* into *k* clusters. Consider all possible k^2 pairs of subsets A_i, B_j, $i = 1,..., k$, $j = 1,.., k$. For each pair of subsets, we find separating hyperplanes by the method of convex hulls linear separation, which is described by us previously. If the number of errors does not correspond to the given significant level, we increase the number of clusters by 1. If the number of clusters is very large according to the volume of samples, we are talking about the impossibility of classifying sets at a predetermined significant level of errors. If the significant level ε is satisfied, then the solution of the classification problem is a set of optimal separable hyperplanes of all pairs of subsets.

The algorithm complexity of the proposed method is $O(n)$, which is less than the complexity of the nonlinear Support Vector Machine algorithm.

Makhrova Ye.G.

CALIBRATION OF THERMOELECTRIC RECEPTORS WITH A FLAT RECEIVING PLANE

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Receivers based on anisotropic thermoelements are used in industrial sanitation in energy radiometers, in medical diagnostic instruments by the method of dynamic heat-metering, namely:

- in diagnostics of functional state of the kidneys, for detection of pyelonephritis or glomerular nephritis (Kalugin V.O., Pishak V.P. Dynamic Radiation Thermometry, Opportunities and Perspectives.-Chernivtsi, - Prut-2009.- 244);
- in diagnosis of the thyroid gland to determine its functional state (Gozhenko A.I., Berezovskaya M.E., Vetoshnikov B.C., etc. Method and device for temperature monitoring of the functional state of the thyroid gland in radiation damage - Radiation damage and development perspectives of personal protective equipment from ionizing radiation - M., 1992.- S. 101-107);
- in gynecology for detection of inflammatory processes, the function of the placenta, (Gozhenko A.I., Dikusarov V.V., Orenchuk B.C. Relationship between the level of radiation heat loss from the placenta and its function in EHR gestosis - Actual issues in morphogenesis: Mater. Conf.-Chernivtsi, 1996. pp. 87-88), (Gozhenko A.I., Dikusarov V.V., Orenchuk B.C. Usage of the test with the change of position of the body of a pregnant woman in the diagnosis of disorders of the placenta function - Actual problems of morphogenesis: 20 Mater. Sci., Conf. - Chernivtsi, 1996. - P. 88-89). Etc.

Calibration, that is, verification of the instrument parameters by comparing them with the indicators of exemplary devices, are widely used in modern instrument making, and is one of the last operations in the manufacture of devices. This method relates to the calibration of devices for contactless diagnostics on human radiation, and can be used to calibrate radiation receivers with heat-sensitive elements based on anisotropic thermocouples, i.e., heat receivers with a flat receiving plane. The calibration of thermoelectric receivers with a flat receiving plane is as follows. For calibration, a heat measuring cell consisting of a thermostat block is used, inside which, symmetrically with respect to the side walls, a flat metal core (0.2 mm thick plate) with a heater inside, on both sides of which two identical thermoelectric receivers with a flat receiving plane installed closely, are fixed.

The electric heater has the shape and size that coincide with the shape and size of the receiving plane of the thermoelectric receiver; and grading thermoelectric receivers with a flat receiving plane by stepwise change in the power of the heater, measuring the thermoelectric force, plotting the dependence of the signal of thermoelectric receivers with a flat receiving plane on the density of the heat flux for a given thermostatically controlled temperature unit.

The whole procedure for different temperature levels of the thermostated unit is repeated and nomogram of the dependence of the thermo-driving force of thermoelectric receivers with a flat receiving plane for the desired operating temperature interval is obtained.

The proposed method allows producing thermoelectric receivers with a flat receiving plane with an accuracy of not less than 1.5-2%.

Nahirnyak V.M.

STUDY OF THE EFFECT PRODUCED BY LOW-FREQUENCY VIBRATIONS OF LOW EXTRIMITIES ON THE BLOOD PRESSURE IN HUMANS

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Previous studies showed the increase of systolic and diastolic blood pressures in patients when they were exposed to low-frequency vibrations of the whole body. There were a few reasons why that might happen. One of the reasons why that might happen is the increase in the heart stroke volume and the overall cardiac output. Hagen–Poiseuille equation to model a circulation of blood was used:

$$p = \frac{8\eta \cdot L \cdot Q}{\pi R^4}\ , \qquad (1)$$

where $\boldsymbol{p}$ – is blood pressure, $\boldsymbol{Q}$- is cardiac output (CO) , $\boldsymbol{\eta}$ – is viscosity of blood, and $\boldsymbol{R}$ – is an effective radius of blood vessels. Cardiac output is a product of stroke volume (SV) and the heart rate.

As one can see the pressure is proportional to the cardiac output and inversely proportional to the fourth power of the effective radius of blood vessels.In order to verify how well this model works, we tried to study how the blood pressure changes in case when we expose only a part of a patient's body to low-frequency vibrations. The most suitable parts of the body in this case were legs.

We conducted our study in two groups of 15 people, males and females. They had a normal weight and did not admit taking any heart-related medication on a regular basis. The age of patients ranged from 19 to 65 years. In our experiments, patients were sitting on a chair with their feet positioned on the vibrating platform. They all underwent a vibratory massage session on the Tienes S780 blood circulative massager (Tianjin, China). The vibration frequency was 1200 oscillations per minute. Duration of the vibrational massage was 10 minutes. The blood pressure and the heart rate were measured twice, before and immediately after the massage with the personal blood pressure meter Rossmax MS60 (Taipei, Taiwan).

The preliminary results showed a decrease approximately by 10 percent in both systolic and diastolic blood pressures in men and women. The heart beat remained almost unchanged in all the experiments.

The suggested model evidenced that the main factor contributing to the reduction of blood pressure is an effective radius of blood vessels, $\boldsymbol{R}$. According to the formula (1), if the radius becomes larger during the experiments, the blood pressure decreases. The other contributing factor, cardiac output, remained unchanged at the same time. We can make such an assumption since there was no direct exposure of the patients' hearts to periodic vibrations. The periodic vibrations might result in an increased elasticity of limbs' muscles during the massage and the ability of blood vessels to expand. Thus, the greater elasticity leads to an increase in the effective radius of blood vessels.

The further step in this investigation may be the study of dependence of the value in blood pressure reduction and the duration of low frequency vibrational massage.

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ВИКОРИСТАННЯ ЛАЗЕРІВ В МЕДИЦИНІ

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Біологічні тканини є оптично неоднорідні середовища з поглинанням, в яких розповсюдження світла залежить від розсіювальних та поглинальних характеристик компонентів біотканини. Серед оптичних методів дослідження та візуалізації структури останніх одне із провідних місць займають поляризаційні методи дослідження, засновані на аналізі їх поляризаційних властивостей при опроміненні лазерним випромінюванням. Лазерне випромінювання та неполяризоване світло можуть поглинатися й розсіюватися біологічними тканинами. Внаслідок чого дослідження процесів дає інформацію про мікро- та макроструктури середовища, його складових.

В оптичних схемах для отримання поляризаційних зображень досліджуваних об'єктів використовується, в основному, гелій-неоновий лазер потужністю 5мВт, довжиною хвилі 632,8 нм. Поляризаційний освітлювач містить чвертьхвилові пластинки та поляризатор, дозволяє аналізувати зображення, які отримуються за допомогою мікрооб'єктива та проектується в площину світлочутливої площадки CCD-камери, що дозволяє вимірювати розміри структурних елементів від 2 до 2000 мкм. Вся інформація відтворюється, записується і зберігається на комп'ютері, і це дозволяє проводити моделювання мікрополяризаційної структури біозразка у просторово-координатних мережах. На основі даного метода вивчаються характеристики локальних поляризаційних та анізотропних параметрів біозразків, що проявляють максимальну чутливість до зміни структури, оптичних властивостей зондуємого середовища.