УДК 615.47:616-073

N.I. ZABOLOTNAYA, S.V. PAVLOV, R.H. ROVIRA, B.P. OLIYNICHENKO
Vinnitsa National Technical University
rnldrovira@gmail.com

COMPUTER DIAGNOSTICS OF OPTICAL AND ANISOTROPIC STRUCTURE OF BLOOD PLASMA ON THE BASIS OF FUZZY SETS

Annotation. Development of mathematical model on the basis of a method of fuzzy sets for estimation of parameters of system of a phase tomography of biological tissues was presented.
Keywords : anisotropic, blood plasma, polarimetric diagnosis.

Н. І. ЗАБОЛОТНА, С. В. ПАВЛОВ, Р. Х. РОВІРА, Б. П. ОЛІЙНИЧЕНКО
Вінницький національний технічний університет
rnldrovira@gmail.com

КОМП'ЮТЕРНА ДІАГНОСТИКА ОПТИЧНОЇ І АНІЗОТРОПНОЇ СТРУКТУРИ ПЛАЗМИ КРОВІ НА ОСНОВІ НЕЧІТКИХ МНОЖИН

Анотація. Представлено розробку математичної моделі на основі методу нечітких множин для оцінки параметрів системи фазової томографії біологічних тканин.
Ключові слова: анізотропний, плазма крові, поляриметрична діагностика.

Introduction. Among the means of optical diagnosis of biological tissues, the methods of laser polarimetric diagnosis of optical anisotropic structure have a widely relevance. In this area, the coordinate distribution of the azimuth and the ellipticity of the polarization of the laser imaging of biological tissues are defined with the subsequent processing, based on the method of fuzzy sets. On this basis, a number of methods of early diagnosis are developed for the differentiation of pathological changes in the structure of biological tissue (BT), associated with their degenerative dystrophic changes and cancer.

Objective. Develop mathematical models on the basis of fuzzy sets for estimating the parameters of a phase tomography of biological tissues, which allows a direct measurement of Mueller matrix image to allocate direct information on the distribution of the phase shifts, which can be used to determine the objective criteria for diagnosis of biological tissues.

Method and data processing. The study of manifestations optical anisotropic albumin-globulin plasma system was performed using a laser polarimeter. The studied materials were selected samples of histological sections of muscle tissue (MT) and the dermis of human skin (HS) with extinction coefficient for optically thin layer ($\tau < 0.1$). Local values of azimuth of polarization in each point of the laser image of human blood plasma were defined and the polarizing picture $\alpha(m \times n)$ and $\beta(m \times n)$ of the polycrystalline protein system was obtained. Statistical moments of the 1st - 4th order were used to quantify the distributions.

A comparative study of plasma samples of three groups of patients was carried out: healthy (group A, 20 patients), patients with benign changes (group B, 19 patients) and patients with breast cancer (group C, 17 patients). Each degree of change was expressed in the form of linguistic terms of quality: low (H), below average (HC), medium (C), above the average (BC), high (B). For each of databases for the purpose of formalization of indicators the corresponding membership functions were defined. Mathematical expressions for differential diagnosis of cancer diseases by estimation of average value M1, dispersion M2 of $\alpha(m \times n)$, $\beta(m \times n)$ of laser images of samples of plasma of blood of different groups of patients were formulated.

For realization of information system of processing of biomedical information the operator's interface was developed on the basis of fuzzy sets. The operator's interface includes the menu for save function, membership functions, fuzzy processing and results display as shown in fig.1.
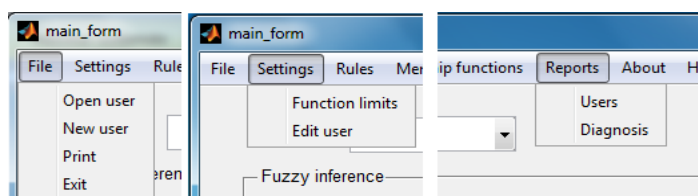

Fig.1 Operator's interface

Conclusion. A mathematical model on the basis of a method of fuzzy sets was developed for estimation of parameters of system of a phase tomography of biological tissues for definition of objective criteria of diagnosis of human biological tissues. Results of comparative researches of samples of plasma of blood of three groups of patients were presented and an information expert system of processing of biomedical information was proposed.