B2 Inverse Problems and Biosignal Processing 2
Time: Thursday, 16.09.2010, 4:10 p.m.
Location: Humboldt-Building, Room 211 / Foyer

Poster Session:

Chairman: P. Husar (DE-Ilmenau)

H. Welp, V. Jaedicke, Ch. Kasseck, N. C. Gerhardt, M. R. Hofmann (DE-Bochum)

Spectral pattern classification in optical coherence tomography

In recent research on optical coherency tomography (OCT) several approaches are pursued to retrieve not only morphological information from the analysis of the backscattered light but also depth dependent spectroscopic information. Since many substances in life science and material science have characteristically shaped spectral extinctions in principle this allows depth dependent substance identification. We present a concept using a pattern recognition algorithm to perform depth resolved substance identification in non-scattering samples based on spectral features. A proof of principle is given by frequency domain OCT (FD-OCT) measurements of a multilayer absorbing sample. The reconstruction of depth dependent spectra is done by a windowed Fourier transform of individual peaks in the complex FD-OCT depth profile. Based on the reconstructed spectra transmission functions are calculated iteratively for certain depth regions. Then the transmission functions are classified according to the known transmission profiles of expected substances using a pattern recognition algorithm. For a multilayer sample with four different absorbers our concept yields an overall sensitivity of 80% and an overall specificity of 96%. These results were achieved without performing calibration measurements in order to eliminate systematic errors. Thus high performance, fault tolerant substance identification based on spectral changes caused by absorption is feasible. The fault tolerance of our concept is especially important for real applications where calibration measurements are not applicable. Our proof of principle outlines the potential of spectral feature based substance identification in non scattering samples e.g. for material sciences. With further improvements this concept can be extended to strongly scattering media like biological tissue.

A.Sh. Avshalumov, G.F. Filaretov, V.B. Markovsky, E.N. Sinitsyna

The Method of Principal Components as an Instrument for Analysis of Oral Glucose Tolerance Test Dates

It is proposed to use the method of principal components (MPC) as an instrument for date's analysis of oral glucose tolerance test (OGTT), which plays very important role in diabetic diagnoses. This test is realized by the taking fasting of dry 75 g glucose dissolved in 250 ml of water, and measuring concentrations of immunoreactive insulin (IRI), glucose and C-peptide in blood plasma at the initial (zero) time and after 30, 60, 120 minutes after taking. Standard processing of test results is usually limited to fixing the initial and end levels of IRI, evaluation of various indexes (CARO, HOMA-IR, HAFFNER, etc.). This method does not allow to extract all useful information from measurements. As it was shown on the basis of sufficiently representative clinical material, using of the MPC for OGTT data processing is very perspective. This is established, that: - basic information about the presence and level of hyperinsulinemia is contained in the first principal component F1; - F1 values for healthy patients and patients with signs of pathology are clearly separated; - there is a significant correlation values F1 and standard indexes; - dynamics of change in F1 values can clearly judge about the efficiency of therapeutic procedures. Stability of diagnostic results by using indicator F1 with increasing number of examined patients and correction of the estimated coefficients in formula for F1 are considered.