To the Question of Application the Structures of Basic Functions

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Abstract - **Two cell-matrix structures of basic functions for smoothing by means of a joint processing the data of trajectory measurements with spatial and temporal redundancy were considered.**

Keywords - **Basic functions, cell-matrix structures, spatial and temporal redundancy.**

I. INTRODUCTION

Trajectory measurements are the process of measuring the primary parameters of the object's position and motion. So an important task is to develop and to use new applied methods of trajectory information analysis, which are based on flexible use of redundant measurements to improve the accuracy and reliability of results.

II. THE STRUCTURE OF BASIC FUNCTIONS

An important characteristic of the trajectory information is spatial and temporal redundancy. The spatial redundancy (SR) is appeared due to multiple duplication of measurements and temporal redundancy (TR) is formed due to high rate of data acquisition. A distinctive feature of the trajectory measurements is an extremely high required accuracy and a close interconnection between the processes of measurement and data processing.

In the 70's the methods that more full take into account both spatial and temporal redundancy of the data of trajectory measurements have been developed. This is made possible by a high-performance PCs. To these methods the two options of successive implementation of spatial and temporal redundancy of the data of trajectory measurements are referred. At the same time on one stage the temporal redundancy is realized and on the other stage the spatial redundancy of the data of trajectory measurements is realized. The sequence of processing steps can be arbitrary.

In the 80's the methods of nonlinear adaptive optimal smoothing, allowing the joint implementation of spatial and temporal redundancy of polyvalent data of measurements have been developed [1]. At present time the real conditions for the development of algorithms of the joint implementation of spatial and temporal redundancy of the data of trajectory measurements are created. This is made possible by progress in development of computer technologies that have great speed and memory.

For a polynomial description of the stochastic trajectories by a joint implementation of spatial and temporal redundancy a system of basic functions and a vector of smoothing polynomial coefficients is introduced [2, 3]. The composition and the value of this vector will be determined in the course of processing. In this paper we propose two cell-matrix structures of basis functions for smoothing the data by a joint processing of trajectory measurements with spatial and temporal redundancy.

The first structure:

$$j(t) = \begin{vmatrix} j_x(t) & 0 & 0 \\ 0 & j_y(t) & 0 \\ 0 & 0 & j_z(t) \end{vmatrix} \quad (1)$$

where $j_l(t) = \left| (t-t_0)^1 ...(t-t_0)^k ...(t-t_0)^m \right|$;

l = x, y, z;

m – the degree of smoothing polynomial;

t – the current moment of time;

t_0 – the moment of time corresponding to the middle of the smoothing interval.

The second structure:

$$j(t,t) = \begin{vmatrix} j_{00}(t,t_x) & j_{01}(t,t_x) & j_{02}(t,t_x) & .. & j_{m0}(t,t_x) & j_{m1}(t,t_x) & j_{m2}(t,t_x) \\ j_{00}(t,t_y) & j_{01}(t,t_y) & j_{02}(t,t_y) & .. & j_{m0}(t,t_y) & j_{m1}(t,t_y) & j_{m2}(t,t_y) \\ j_{00}(t,t_z) & j_{01}(t,t_z) & j_{02}(t,t_z) & .. & j_{m0}(t,t_z) & j_{m1}(t,t_z) & j_{m2}(t,t_z) \end{vmatrix} \quad (2)$$

where $j(t,t) = (t-t_0)^0 t_l^0 (t-t_0)^0 t_l^1 (t-t_0)^0 t_l^2 ... (t-t_0)^m t_l^0 (t-t_0)^m t_l^1 (t-t_0)^m t_l^2$;

τ_l – the second independent variable of a basic function.

III. CONCLUSION

Thus, two cell-matrix structures of basis functions are considered, which can be used in the implementation of non-linear adaptive optimal smoothing method. Also the orthogonality check of basis functions is done, confirming the correctness of their choice.

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