PARALLEL COMPUTING FOR MULTI-DIMENSIONAL SIGNALS ACQUISITION AND PROCESSING

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This paper presents the design and research results of the digital systems with parallel computing for the acquisition and processing of multi-dimensional signals The obtained results can be applied to solve the problem of parametric and functional testing of Printed Circuit Board (PCB), in which concurrent processes are specific for real-time data acquisition and processing [1,2,3].

For this aim, the Printed Circuit Board (PCB) is defined based on a two-dimensional space with: a set of nodes for the test signals generating $\boldsymbol{U^{In}} = \left\{ \boldsymbol{u_i^{In}}, \forall \boldsymbol{i} = \overline{\boldsymbol{1,N}} \right\}$ and a set of nodes for acquisition of state signals $\boldsymbol{U^{Out}} = \left\{ \boldsymbol{u_j^{Out}}, \forall \boldsymbol{j} = \overline{\boldsymbol{1,K}} \right\}$.

The state signals acquisition is performed by approximating them by applying the Fuzzy logic method determined by the equation $\boldsymbol{Y_{j,l}} = \begin{cases} 1 \left| \boldsymbol{A_l \dot{u}_j^{Out}} \in \Delta \boldsymbol{u_l}, \right. \\ 0 \left| \boldsymbol{A_l \dot{u}_j^{Out}} \notin \Delta \boldsymbol{u_l} \right. \end{cases}, \forall \boldsymbol{l} = \overline{\boldsymbol{1,L}}$, where $\boldsymbol{L}$ is the number of bits for the speed approximating of the input signal increase.

Parametric and functional analysis of Printed Circuit Board is performed based on mathematical models [2,3]:

$$\boldsymbol{F}\left(\frac{\boldsymbol{U^{Out}}}{\boldsymbol{U^{In}}}\right) = \begin{bmatrix} \frac{\partial \boldsymbol{u_1^{Out}}}{\partial \boldsymbol{u_1^{In}}} & \cdots & \frac{\partial \boldsymbol{u_K^{Out}}}{\partial \boldsymbol{u_1^{In}}} \\ \cdots & \cdots & \cdots \\ \frac{\partial \boldsymbol{u_1^{Out}}}{\partial \boldsymbol{u_N^{In}}} & \cdots & \frac{\partial \boldsymbol{u_K^{Out}}}{\partial \boldsymbol{u_N^{In}}} \end{bmatrix} \text{ and } \boldsymbol{F}\left(\frac{\boldsymbol{U^{Out}}}{\boldsymbol{U^{Out}}}\right) = \begin{bmatrix} \frac{\partial \boldsymbol{u_1^{Out}}}{\partial \boldsymbol{u_1^{Out}}} & \cdots & \frac{\partial \boldsymbol{u_K^{Out}}}{\partial \boldsymbol{u_1^{Out}}} \\ \cdots & \cdots & \cdots \\ \frac{\partial \boldsymbol{u_1^{Out}}}{\partial \boldsymbol{u_K^{Out}}} & \cdots & \frac{\partial \boldsymbol{u_K^{Out}}}{\partial \boldsymbol{u_K^{Put}}} \end{bmatrix}, \ \forall \boldsymbol{i} = \overline{\boldsymbol{1,N}}, \boldsymbol{j} = \overline{\boldsymbol{1,K}}$$

Keywords: *Parallel computing; Data acquisition and processing; Multi-dimensional signals; Printed Circuit Boards.*

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