Architecture of Multi-Channel Digital Filters Under Conditions of Limited Energy Resource

P.E.Baranov, A.N. Sheik-Seikin, D.A. Zaburunnov

Abstract – **In this paper the synthesis and study of the effectiveness of the architecture of multi-channel digital filters of complex signals compression, working under limitation of the total energy of the probing signal are given..**

Keywords - **multichannel compression filter, information links graph, computing architecture, computing system.**

The results of synthesis of algorithms for multi-channel signal detection under restrictions on the resulting radiation energy e_0 and time of the review of controlled zones T_0 show that the signal processing system must be able to redistribute the energy of the probe signal between channels adequately to noise conditions for the optimization of a system performance - for example - the average risk [1], [2]. Accordingly, the multi-channel compression filter (MCCF) should be able to reallocate its computing resources between channels, since the traditional solution, intended to maximize performance for each channel, leads to unnecessarily large hardware expenses.

To solve the problem of synthesis and analysis of structures the graph theory technology is applied, in particular - representation of the algorithm implemented in the form of a graph of information connections - the GIC.

Based on this approach the proposed method of synthesis of architecture MCCF, realized as a finite impulse response filter (FIR) on the minimal variation of the basic vector GIC dimension and taking into account the linear dependence of relation parameter/resource (signal base / number of filter stages).

we'll obtain the structure of the resulting graph G_0 (see Fig. 1) that displays the structure of L-channel computing system (CS) with a given property ($h_i = f(p_i)$) and the optimal cost computational resources Q_B, since it corresponds to $\{P_i^{max}\}$, i.e. such as the vector of parameters from a given set, in which the desired resource is greatest and unused vertices missing.

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Porfiriy Baranov – Odessa National Polytechnic University, Shevchenko Av., 1, Odessa, 65044, UKRAINE, E-mail: pbe@irt.opu.ua

Anatoliy Sheik-Seikin – Odessa National Polytechnic University, Shevchenko Av., 1, Odessa, 65044, UKRAINE, E-mail: ans@irt.opu.ua

Dmitriy Zaburunnov – Odessa National Polytechnic University, Shevchenko Av., 1, Odessa, 65044, UKRAINE, E-mail: dimazzi@rambler.ru
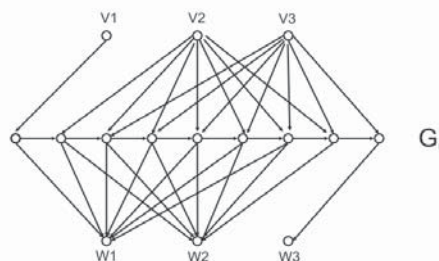
Fig.1 The structure of the resulting graph

The synthesized architecture of CS, implements the algorithm contained, by analogy with [5], is called the "association".

We obtain the condition of preference of associative architecture in comparison with traditional, in the form of requirements of SE used in the CS $\gamma < 0,5(L-1)/(L+1)$, where L - number of channels. As follows from it, if the relative complexity of the implementation of SE in the elementary system does not exceed 15% of the computational complexity of elementary computing unit when the number of channels equal to 2, it should be associative architecture; increasing number of channels - requirements to the SE reduced, reaching 50% for large L.

Thus, the efficient architecture of multi-channel digital filters of complex signals compression, working within the constraints of the total energy of the probing signal was synthesized.

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