STATEMENT OF THE PROBLEM OF SYNTHESIZING SIGNALS MADE UP OF ELEMENTS REPRESENTABLE BY SEGMENTS OF A GENERALIZED FOURIER SERIES

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The application and universality of a representation of generalized composite signals have been substantiated. The problem of synthesizing them has been stated, and its geometric treatment has been given; the generality of such a statement of the problem has been demonstrated.

In the theory of synthesizing radioengineering signals, the solution is sought in a broad class of functions or can be reduced to determining the optimal parameters of a predetermined function. In the first case, the synthesized signals most frequently cannot be applied due to the complexity of constructing high-frequency shapers; in the second case they do not offer substantial advantages over already known ones.

Below, it is proposed to seek the solution of the general problem of synthesizing signals in the class of practically realizable functions which have a high degree of freedom of parameter selection. The signals s(t) belonging to such a class are called generalized composite signals (GCS), i.e., signals consisting of elementary signals

$$s(t)=\sum_{j=1}^{M} G_j(t-\tau_{j-1}), \quad 0\leqslant t\leqslant T, \tag{1}$$

where $G_j(t-\tau_{j-1})=\begin{cases} G_j(t), & \tau_{j-1}\leqslant t<\tau_j; \\ 0, & \text{for other } t \end{cases}$ is an element of the composite signal (ECS); $j=\overline{1,M}$; $\tau_j = \sum_{k=1}^{j} \tau_k$; τ_k, $T=\sum_{k=1}^{M} \tau_k$ are the lengths of the k-th ECS and GCS. For j = M the point t = T is included in this ECS here and below.

The distinguishing singularity of a GCS is the representation of $G_j(t)$ on the interval $\tau_{j-1} \leq t < \tau_j$ by means of a generalized Fourier series (see [1]) whose basis $\Phi_j=\{\psi_{ij}(t),\ i=1,2,\ldots\}$ is chosen from the set F of functions that are easily realizable circuit-wise. If we restrict ourselves to N_j terms of the series, then the ECS

$$G_j^{N_j}(t)=\sum_{i=1}^{N_j} P_{ij}\psi_{ij}(t), \quad \tau_{j-1}\leqslant t<\tau_j, \tag{2}$$

where P_{ij} is the i-th expansion coefficient in the j-th basis.

From Eqs. (1), (2) it follows that in the general case for $t = \tau_j$, j = 1, ... (M - 1), a discontinuity in the phases of neighboring ECS is possible.

It is convenient to use physically realizable - for example, harmonic and random-walk - functions as the basis functions. For them $\{P_{ij}\}$ are real, and formation of GCS on the basis of these basis functions is possible using various methods (see [2,3]).

The method of implementing GCS of the type (1) is determined by the form of the basis functions used. The latter are formed by devices whose natural waves correspond to the chosen basis functions. For example, GCS based on harmonic functions may be formed using surface acoustic waves (SAW), while those based on random-walk functions may be formed using microcircuitry. GCS may be formed by apodized nonequidistant SAW transducers (see [2]). Methods for weighting random-walk functions and summing them have likewise been

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