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THE PHASE RELATIONSHIPS AND A TECHNIQUE FOR DIMINISHING MEASUREMENT ERRORS IN MULTIFREQUENCY RETRANSMITTING SYSTEMS

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New phase relationships are derived for miltifrequency retransmitting measurers dealing with continuous unmodulated signals at different carrier frequencies. Analysis of errors of the method is performed, and a technique of their reduction, with account for asymmetry of deviations of phase increments from the linear law, is investigated. The domains of maximum error values are determined, and their relationship to the level of the spurious side component of the spectrum within the range of unambiguous measurement is examined. A new function for error approximation in the domain of maximal values is suggested.

The retransmission method, suggested in [1] for modification of radar sensors operating at short ranges, has a number of advantages. However, analysis of this method and of errors due to spurious components of the spectrum arising from signal transformation in the retransmitter [1, 2] has been implemented only for continuous radiation with the harmonic frequency modulation. Other signals are often more convenient for application, particularly, several continuous unmodulated harmonic oscillations with different frequencies. These oscillations can be radiated by a retransmitting measurer either simultaneously, or in sequential time intervals.

The purpose of this work is to determine phase relationships for the multifrequency retransmitting measurers, to assess the errors arising from limited suppression of side spectral components (the latter occur at transformation of a radio wave in the retransmitter), and to consider some techniques of the error reduction. The analysis will be carried out for conditions, when the uncontrollable parameters are slowly changing during the measurement period, and these changes may be neglected. The relationships obtained can be employed for designing the checking devices of various purposes, for example, multiscale measurers.

Select a network, which periodically, one-by-one, radiates harmonic oscillations with different frequencies. Let the period T consist of several equal time intervals t_i, and the duration of work τ in each interval exceeds considerably the overall time of the radio wave propagation from the measurer to the object, then to the retransmitter and backwards. The time τ is larger than it is necessary for the measurement, and each interval t_i includes a time interval Δt, during which all transient processes, related to the oscillation switching, die out. The results of measurements in the unit intervals are used for processing of information obtained for the whole period. The time chart of this signal is presented in Fig. 1*a*. This case is equivalent to measurement at several simultaneously radiated continuous oscillations.

Figure 1*b* shows the mix of the measuring retransmitting system (MRS) realizing the sequential radiation of the continuous unmodulated signal, where: *1* is synthesizer of the radiated signal; *2* — amplifier; *3* — directed coupler; *4* — circulator; *5* — transceiving aerial of the radar sensor; *6* — object under surveillance; *7* — transceiving aerial of the retransmitter; *8* — Y-branch; 9_1, 9_2 — modulated reflectors; *10* — microwave phase shifter by 45°; *11* — low-frequency

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