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im. Jarosława Dąbrowskiego

ROZPRAWA DOKTORSKA - ABSTRACT

CYFROWY MIKROFALOWY DETEKTOR CZĘSTOTLIWOŚCI Z WYKORZYSTANIEM MACIERZY BUTLERA 4 X 4

ppłk mgr inż. Hubert Stadnik

Promotor
prof. dr hab. inż. Bronisław Stec

Promotor pomocniczy
dr inż. Mirosław Czyżewski

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Abstract

This dissertation concerns Microwave frequency discriminators (MFD) that are systems used to develop information on the temporary values of frequency of the received signal. This task can be completed by systems with frequency conversion, systems with microwave resonators or even band-pass filters. Very good results of immediate broadband measurement of the frequency of microwave signals are achieved by devices where the interferometric properties are used. The results, slow-changing amplitude signals are obtained which value depends on the frequency of the input signal, are obtained almost in no time. This delay results only due to signal propagation time through few microwave elements. Thanks to that benefits, it is widely used as the main part of instantaneous frequency measurement (IFM) receivers. The overall structure of the discriminator consists of the element develop two signals, whose phase difference is proportional to the frequency of the input signal. One of the possible implementations of this task consists of a signal splitting element and two transmission lines of different lengths. Another element of MFD is the microwave phase detector system (MPhD), which is designed to generate slow-changing signals proportional to the phase difference of the two signals obtained at an earlier stage. To increase the frequency discrimination resolution, lines with a larger length can be used. However, it should be noticed that such a procedure narrows the measurement unambiguity band. For correct operation, several frequency discriminators with different line length may be used. With the increase in the number of MFD with this appropriately selected difference, the sub bands for unambiguous frequency detection may be determined. To facilitate interpretation and use of MFD output signals in other devices, these signals can be converted to digital form. Such type of device is called digital IFM (DIFM). Integration the IFM with the DIFM is the solution for better frequency measurement resolution in a very wide band what is very well known for the devices containing components with ideal characteristics. In this paper is going to be presented a device which use an interferometer implemented in the form of a 4 x 4 Butler matrix. Author will suggest the method of how to tackle the ambiguity of frequency measurement that occurs when the elements with real characteristics are implemented.