

CONCEPT OF MULTISTAGE DISCRETE FOURIER TRANSFORM WITHOUT PERFORMING MULTIPLICATIONS

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Abstract: The issues related to the development and research of digital methods and algorithms for the discrete Fourier transform, which do not require algorithmic multiplication operations, are considered. The aim of the research is to develop and formalize the concept of multistage discrete Fourier transform of complex signals only by algebraic addition of their time samples. The research used the methods of mathematical and hardware-software modeling of the operation of computing algorithms for digital signal processing on programmable logic integrated circuits. The concept of a multistep discrete Fourier transforms without performing multiplications is described. The corresponding formulas for digital signal processing are given. The results of the study showed and confirmed the possibility of this Fourier transform of complex signals only by algebraic addition of their time samples

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Computational algorithms for discrete Fourier transform (DFT) are successfully used in radio engineering, hydroacoustics and aviation. The digitalization of these algorithms has actualized the development and research of recurrent differential digital filtering (DDF) methods for a complex signal. Such methods make it possible to reduce hardware costs when implementing digital DFT algorithms based on DDF in software and hardware. Minimization of the number of multiplication operations in digital algorithms of such DFT allows them to be successfully used to reduce hardware costs in the software and hardware implementation of digital signal processing (DSP) algorithms on Programmable Logic Devices (PLD).

The aim of the research is to develop and formalize the concept of multi-stage DFT (MFT) of complex signals only by algebraic addition of their time samples.

There are methods of mathematical and hardware-software modeling of the operation of DSP computational algorithms on PLD .

The research results have shown and confirmed the possibility of DFT complex signal without performing arithmetic multiplication operations.

The development and formalization of the concept of MFT complex signal by DDF is the development of the theory and methods of multirate MDF, proposed and developed by V.V. Vityazev and S.V. Vityazev. The proposed methods for such a DFT can and should ensure the minimization of hardware costs for DSP when it is implemented in software and hardware on PLD. The reliability of the study results was confirmed by their agreement with the theory and methods of FFT and recurrent DFT. Digital MFT algorithms can be used in DSP to calculate the instantaneous spectra of processed signals similar to digital FFT algorithm and / or for continuous analysis of their spectra similar to the digital recursive DFT algorithms.

Thank you for your attention!