

Proposal DBNS Filter project

The processing of digital signals is a task made very difficult by the limitations of memory and power, which must be allocated to perform the arithmetic computations. The process of filtering a signal using a filter requires large amounts of power to compute the inner products of the finite impulse response. A method to reduce this power consumption was discovered in the late nineties. This technique is called the Double Base Number System (DBNS). It functions by using a system of the first two prime numbers (2,3) that when taken to respective integral powers, will reduce the space required to process the signal. This method has been the topic of much discussion in the past couple of years in several IEEE publications.

The system supposes that a number can be formed with an arbitrary error from the first two prime numbers (a 2- integer). It accomplishes this by finding the two powers (signed integers) that each number must be raised to respectively to form the number within a given margin of error. This process is called 1-digit DBNS, because it attempts to represent a value using only a single signed digit. There is another method within DBNS at our disposal. This other method is called the Hybrid-DBNS and it functions by taking the sum of two signed DBNS digits to fabricate the number desired. The necessity for two digits comes from the problem of representing some small numbers (say 10), which would require the powers to create it within a .01 error to be in the hundreds. In this case it is easier to represent it as the sum of two digits (one being $2^1 * 3^1 = 9$ and $2^0 * 3^0 = 1$, then $9 + 1 = 10$). This process has its limitations because it will require more space and more operations to implement, but it will simplify other calculations. Thus, in each system there is a drawback, which must be examined in greater detail. Both systems benefit from the 2-D mapping, which allows for more elegant ways of reducing further calculations by exploiting geometric patterns and exponential behavior. Another importance aspect of this system is the reduction in the amount of time needed to process

the signal due to the minimal canonical form of the integers that this creates. In minimal form DBNS, one may represent numbers in excess of 256 with three or less terms.

This project will combine the aspects of filter design found in the Electrical Engineering department with the logic chip design features of the Computer Engineering department as it seek to create a processing chip which will be able to implement the aforementioned algorithm. The goal of this project is to create an efficient algorithm as well as to design the filter in order to implement it in a physical filter. The belief is that with this design, the amount of effort and resources needed to handle the processing of a large FIR filter will be reduced. This will in turn allow for larger signals to be filtered with less power consumption.

The final product of this project is...

The method for assuring success for this project is....

This project will be a success because...

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