# Performance Analysis of Vector Operations Using Reconfigurable Computing

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## Abstract

At one extreme of the computing spectrum, we have general-purpose processors that are programmed entirely through software. At the other extreme are application-specific ICs (ASICs) that are custom designed for particular applications. General-purpose processors are designed to execute any application. However, due to the wide applicability of general-purpose processors, a compromise in computational efficiency leads to a reduced performance. On the other hand, ASICS are custom hardware circuits. They provide the precise function needed for a specific task. As such, the designer can produce chips that are faster, cheaper and that consume less power than programmable processors. However, the drawback is that the mapping of an algorithm to a specific architecture limits the range of applicability, leaving you with little flexibility in the choice of applications to run on them.

Many applications (e.g. DSP, multimedia, etc.) with computationally intensive algorithms cannot be run on general-purpose processors and ASICs at an acceptable speed. With the drawbacks found in both the general-purpose processors and ASICS comes the need of a system that gives a better performance. Combining the flexibility of general-purpose processors and the high performance of ASICs would lead to the desired goal. Consequently, this led to the introduction of reconfigurable computing (RC) in the early 1980s that employed both reconfigurable hardware and programmable processors. RC allows the user to define the hardware resources needed for a certain application. The MorphoSys is one example of an RC system, which combines a reconfigurable array of processor cells with a RISC processor core and a high bandwidth memory interface unit. Performance analysis studies of MorphoSys for several applications have been carried out. These have shown an enhanced performance of the MorphoSys over other similar architectural models. Applications taken into consideration include motion estimation, discrete cosine transform, video encoding, and automatic target recognition. The claimed performance of the MorphoSys is at times multiples higher than other architectures.

The main purpose of this paper is to carry out a performance analysis of different linear algebraic algorithms using the MorphoSys RC system. Mainly, these algorithms are concentrated in the areas of one dimensional vectors manipulation: addition/subtraction, multiplication, and other similar operations. It includes the mapping of these algorithms onto the MorphoSys, comparing different ways of mapping, and discussing areas of application.