Autonomous Memory Blocks: Scalable Structured Data Access for Reconfigurable Computing

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Abstract

Many hardware designs, especially those for signal and image processing, involve structured data access such as queues, stacks and stripes. This paper presents parametric descriptions as abstractions for such structured data access, and explains how these abstractions can be supported either as FPGA libraries targeting existing reconfigurable devices, or as dedicated logic implementations known as Autonomous Memory Blocks (AMBs). Scalable architectures combining the address generation logic in AMBs to provide larger storage with parallel data access are also examined. The effectiveness of this approach is illustrated with size and performance estimates for library based and dedicated implementations. It is shown that for two-dimensional filtering, using a dedicated AMB can result in an area improvement of up to 10 and a speed improvement of up to twice in comparison to using libraries.