Real Time Control with Field Programmable Gate Arrays

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Revision History

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Field Programmable Gate Arrays are now inexpensive. Devices large enough to realize complex digital control systems are very reasonably priced. In addition, an engineer can tailor an FPGA design to fit a control algorithm, rather than fit the control algorithm to a processor's capabilities. In effect, there is no bottleneck due to interrupts or event sequencers as in DSP or Micro-Processor designs. Thus, FPGA devices are now very attractive for realizing modern, complex digital controller designs. These designs range from complex AC motor drives to power electronics applications to robotics.

Most real time control systems, particularly for power electronics and AC motor drive applications, require fast data processing. For example, a control loop executing at 10 usec is only 100 kHz, but depending on the algorithm being implemented, this simply may not be enough time to *process the peripherals* and do the real time control algorithm that is *desired*. With FPGA technology, the implementation is tailored to the algorithm. Perhaps more importantly, the peripherals can be tailored to fit the algorithm. This is particularly true of high speed A/D interfaces, resolvers, and encoders. The designer has the flexibility to make the algorithm fully parallel or even fully serial. The designer can obviously make it somewhere in between. This versatility is unmatched in Micro-Processor based architectures.

The use of FPGA technology has been somewhat limited by the tools available for doing designs. Today, there is a link between many different types of tools that can aid the engineer in doing an algorithmically intensive FPGA design. Effectively, there are no barriers to using a FPGA for a high performance, digitally controlled motor drive or power electronic application. The price has become affordable, and the tools powerful for building systems with the *flexibility of digital and the speed of analog*.