

DSP ON FPGAS

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Lecture: Digital Signal Processing is required in many fields. Certain types of DSP, given certain priorities, are best solved using FPGAs. Using FPGAs for DSP comes with unique challenges including; designing to take advantage of parallelism, ensuring linearity and sufficient dynamic range, resource management, timing closure, and debugging. The push to larger, higher performance systems comes with its own challenges including scaling existing systems, timing and synchronisation, and data transport. Certain design methodologies, tools, hardware and software, like those found in CASPER, can make life easier.

1. DSP with an FPGA basics. (vs traditional processors, GPUs etc)
 - high configurability (resource management)
 - variable clock speed (placement, timing)
 - debugging not built in
2. Why do DSP with an FPGA? (as opposed to something else)
 - low latency
 - high IO vs compute ratio
 - configurability
 - efficiency
3. How to do DSP with an FPGA? (CASPER)
 - parallelism
 - abstraction versus efficiency
 - graphical data flow representation vs HDL
 - standard hardware (BEE, iBOB, ROACH, SKARAB, SNAP ...)
 - standard libraries and interfaces
4. Quantization
 - configurable bit widths (rounding strategies)
 - dynamic range
 - linearity
 - floating point
5. Scaling DSP
 - push to more antennas, more bandwidth, more channels
 - networking
 - timing and synchronisation